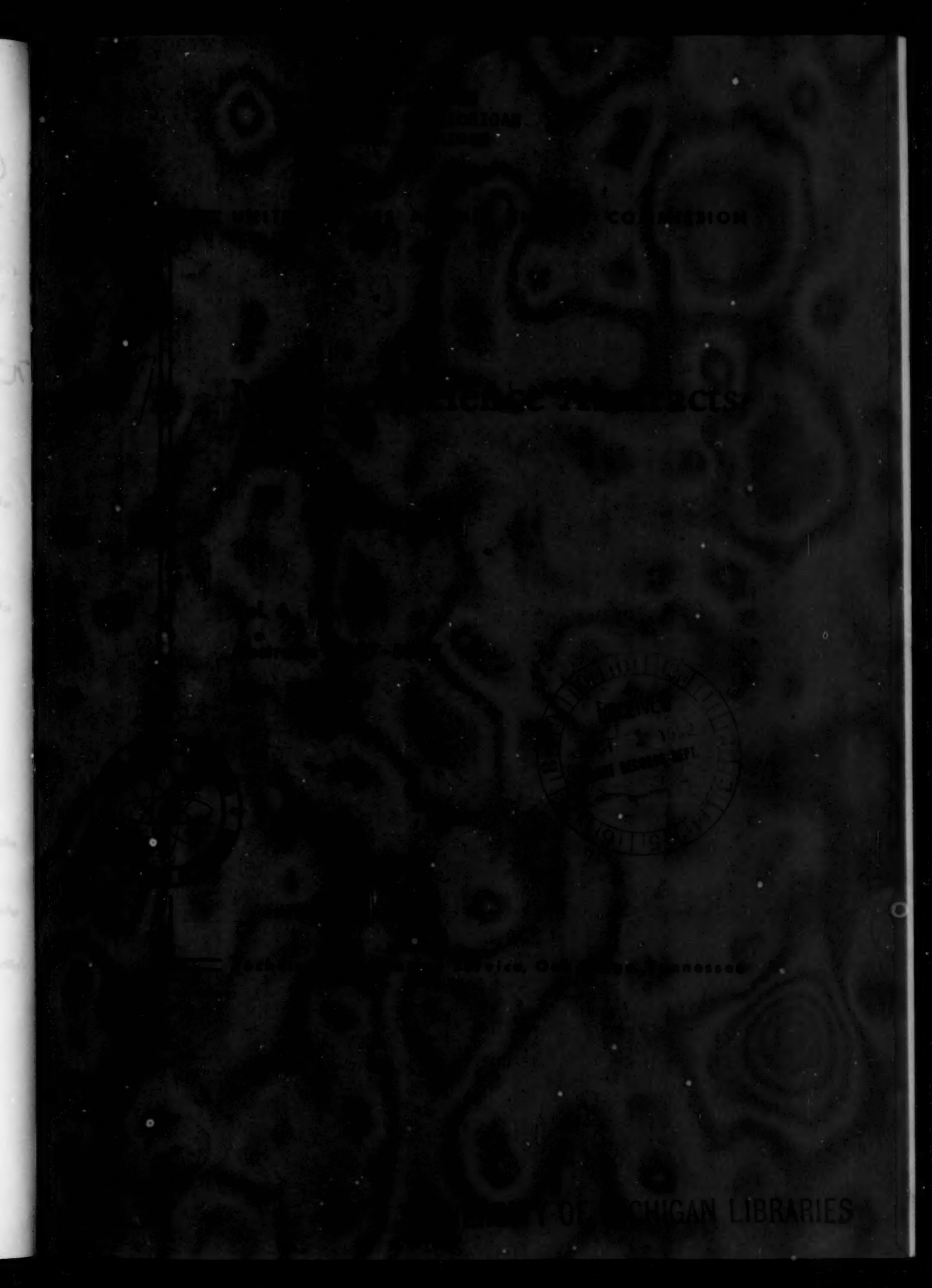

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AECD-3418 5105
National Bureau of Standards
FINAL REPORT TO THE UNITED STATES ATOMIC ENERGY COMMISSION ON THE URANIUM-TITANIUM BINARY SYSTEM, by R. W. Buzzard, R. B. Liss, and D. P. Fickle. [nd] Decl. July 8, 1952. 14p. (AECD-3418; NBS-D-112)

AECD-3419 5238
Los Alamos Scientific Lab.
A CEMENT BASE FOR THE HOT FILAMENT MASS SPECTROMETER SOURCE, by John E. Hand. [nd] Decl. July 17, 1952. 4p. (AECD-3419; LADC-1210)

AECD-3420 5228
Radiation Lab., Univ. of Calif.
THE ALPHA SPECTRA OF Pu^{239} AND Pu^{240}, by Frank Asaro and I. Perlman. May 15, 1952. Decl. July 17, 1952. 18p. (AECD-3420; UCRL-1821)

U. S. ATOMIC ENERGY COMMISSION UNCLASSIFIED REPORTS

AECU-2040 5177
Brookhaven National Lab.
NEUTRON CROSS SECTIONS, by AEC Neutron Cross Section Advisory Group. May 15, 1952. 203p. (AECU-2040)

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ELASTIC SCATTERING OF 9.7-MEV PROTONS BY DEUTERIUM AND BY HYDROGEN, by J. C. Allred, A. H. Armstrong, R. O. Bondelid and Louis Rosen. [nd] 23p. (AECU-2123; LADC-1216)

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MICRO SYNTHESES WITH TRACER ELEMENTS. XXXII. A. THE SYNTHESIS OF TRITIUM LABELED SUCCINIC ACID (BUTANEDIOIC-2,2,3,3,-H_4^3 ACID) AND Di-N-ETHYLENE-SUCCINAMIDE; B. THE SYNTHESIS OF DEUTERIUM LABELED SUCCINIC ACID (BUTANEDIOIC-2,2,3,3-H_4^2 ACID), by D. Lloyd Williams and Anthony R. Ronzio. [nd] 16p. (AECU-2126; LADC-1218)

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EQUIVALENCE THEOREMS FOR PSEUDOSCALAR COUPLING; TECHNICAL REPORT NO. 17, by J. M. Berger, L. L. Foldy and R. K. Osborn. [nd] 15p. (AECU-2127; Technical Report No. 17)

AECU-2129 5214
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INELASTIC COLLISION CROSS SECTIONS FOR 14-MEV NEUTRONS, by D. D. Phillips, R. W. Davis and E. R. Graves. [nd] 13p. (AECU-2129; LADC-1224)

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NUCLEAR ISOMERISM AND SHELL STRUCTURE, A REVIEW, by M. Goldhaber and R. D. Hill. Mar. 17, 1952. 231p. (BNL-1157)

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Institute of Engineering Research, Univ. of Calif.
CREEP OF ALLOYS RESEARCH; TECHNICAL PROGRESS REPORT TO JULY 1, 1952, by E. R. Parker and T. H. Hazlett. July 3, 1952. 4p. (COO-61)

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THE PREPARATION AND INFRA-RED TRANSMISSION OF THIN FILMS OF SOME INORGANIC SULFIDES, by A. E. Cameron. Issued July 9, 1952. 19p. (K-911)

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NYO-3140 5097
Massachusetts Inst. of Tech.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES; PROGRESS REPORT, by F. H. Norton, W. D. Kingery, et al. July 1, 1952. 4p. (NYO-3140)

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BOILING AND CONDENSING OF LIQUID METALS; PROGRESS REPORT, by C. F. Bonilla, J. S. Busch, H. T. Chu and B. Misra. Apr. 24, 1952. 12p. (NYO-3148)

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PROGRESS REPORT FOR JANUARY–JUNE, 1952, by R. Smoluchowski, L. Couling, S. Hayes, C. W. Haynes and R. W. Turner. July 1, 1952. 4p. (NYO-3184)

NYO-3185 5109
Metals Research Lab., Carnegie Inst. of Tech.
ANNUAL REPORT FOR THE PERIOD JULY 1, 1951–JUNE 30, 1952, by R. Smoluchowski, R. Flanagan, C. W. Haynes, L. Couling, S. Hayes and R. W. Turner. July 8, 1952. 8p. (NYO-3185)

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NYO-3640 5098
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THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS; PROGRESS REPORT, by F. H. Norton, W. D. Kingery, et al. July 1, 1952. 3p. (NYO-3640)

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BIBLIOGRAPHY OF HAFNIUM OXIDE, HAFNIUM SILICATE AND HAFNIUM CARBIDE, by C. E. Curtis. Issued July 17, 1952. 22p. (ORNL-1321)

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THE INTERNAL CONVERSION CORRELATION FOR MIXED CONVERSION TRANSITIONS, by M. E. Rose and L. C. Biedenharn. Issued July 25, 1952. 9p. (ORNL-1324)

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A HIGH TEMPERATURE CALORIMETER FOR SOLID STATE MEASUREMENTS; A REPORT OF ACTIVITIES [FOR] SEPTEMBER 1951–JUNE 1952, by E. E. Stansbury. June 1, 1952. 66p. (ORO-74)

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ISOMERIC TRANSITIONS IN Tc^{97} AND Tc^{99}, by Heinrich A. Medicus and Harry T. Easterday. Apr. 18, 1952. 11p. (UCRL-1518)

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Atomic Energy Project, Univ. of Rochester
THE OCCURRENCE OF LYMPHOCYTES WITH BILOBED NUCLEI IN CYCLOTRON PERSONNEL, by M. Ingram, M. Adams, L. Coonan, J. Jespersen, G. Nielsen, D. Platt, and G. Yettewich. June 16, 1952. 11p. (UR-211)

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[Aircraft Nuclear Propulsion Project]
FORCED CONVECTION HEAT TRANSFER IN A PIPE SYSTEM WITH VOLUME HEAT SOURCES WITHIN THE FLUIDS, by H. F. Poppendiek and L. Palmer. Nov. 20, 1951. 18p. (Y-F30-3)

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Atomic Energy Research Establishment, Harwell, Berks (England)
THIN FILMS; A SYMPOSIUM SPONSORED BY THE CHEMISTRY DIVISION, A.E.R.E., HARWELL AND HELD AT BUCKLAND HOUSE, 14-15TH MARCH 1951. F. Hudswell and C. J. Mandleberg, eds. Feb. 15, 1952. 51p. (AERE-C/R-861)

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AERE MED/R-914 5021
Atomic Energy Research Establishment, Harwell, Berks (England)
THE REDUCTION OF RADIATION DOSE IN CHEST RADIOGRAPHY, by G. M. Ardran and H. E. Crooks. Apr. 25, 1952. 4p. (AERE MED/R-914)

BM-RI-4882 5051
Bureau of Mines
VOLUMETRIC DETERMINATION OF SMALL QUANTITIES OF URANIUM WITH SPECIAL REFERENCE TO ERRORS ASSOCIATED WITH USE OF JONES REDUCTOR, by Claude W. Sill and Heber E. Peterson. June 1952. 26p. (BM-RI-4882)

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Chalk River Project (Canada)
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THE THEORY OF NEUTRON DIFFRACTION BY GASES I, by N. K. Pope. May 1952. 61p. (CRT-505)

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INVESTIGATION OF EFFECTIVE THERMAL CONDUCTIVITIES OF POWDERS, by R. G. Deissler and C. S. Eian. June 24, 1952. 44p. (NACA-RM-E52C05)

NACA-RM-E52D17 5089
Lewis Flight Propulsion Lab., NACA
EXPERIMENTAL INVESTIGATION OF AVERAGE HEAT-TRANSFER AND FRICTION COEFFICIENTS FOR AIR FLOWING IN CIRCULAR TUBES HAVING SQUARE-THREAD-TYPE ROUGHNESS, by Eldon W. Sams. June 27, 1952. 43p. (NACA-RM-E52D17)

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PENETRATION AND DIFFUSION OF X-RAYS: CALCULATION OF SPATIAL DISTRIBUTIONS BY SEMI-ASYMPTOTIC METHODS, by L. V. Spencer. June 18, 1952. 44p. (NBS-1726)

NP-3932 5043
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PREPARATION AND PROPERTIES OF INORGANIC HYDRIDES; FINAL REPORT TO THE OFFICE OF NAVAL RESEARCH; JANUARY 1, 1950 THROUGH DECEMBER 31, 1951, by Albert E. Finholt. June 1, 1951. 7p. (NP-3932; U22525)

NP-3940 5065
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INVESTIGATIONS OF THE MOLECULAR STRUCTURES OF CERTAIN COMPOUNDS OF BORON BY THE METHOD OF ELECTRON DIFFRACTION, by Kenneth Hedberg and Verner Schomaker. June 15, 1952. 35p. (NP-3940; Technical Report No. 3; U22598)

NP-3955 5176
Mallinckrodt Chemical Lab., Harvard Univ.
A NOTE ON ROTATIONAL LINE STRENGTHS IN SLIGHTLY ASYMMETRIC ROTORS, by David R. Lide, Jr. [nd] 10p. (NP-3955)

NRL-3973 5240
Naval Research Lab.
APPLICATION OF THE FRANCK-CONDON PRINCIPLE TO COMPLEX SYSTEMS, by Melvin Lax. June 17, 1952. 19p. (NRL-3973)

NUCLEAR SCIENCE ABSTRACTS

Vol. 6 September 15, 1952 No. 17

GENERAL

ATOMIC POWER

5007

UTILIZATION OF WASTE HEAT FROM THE BRITISH EXPERIMENTAL PILE. J. Walker and H. J. Grout. Nucleonics 10, No. 3, 58-60(1952) Mar.

Design studies leading to the installation of the heat exchanger to supply hot water for heating laboratory buildings with waste heat from BEPO are reviewed. Graphs show the effects on pile reactivity of variations in heat-exchanger design, variation in amount of heat extracted from air stream with water of different temperatures for different heat-exchange-surface areas, effect of surface area on draft loss, and the characteristics of the reactor cooling system.

BIOLOGY AND MEDICINE

5008

THE RHEOLOGY OF BLOOD. A SURVEY. Alfred L. Copley. J. Colloid Sci. 7, 323-33(1952) June.

The anomalous flow properties and fluidity of blood, hemodynamics, shape changes and sedimentation of blood cells, clotting mechanism, and hemostasis are reviewed briefly. 53 references.

RADIATION EFFECTS

5009

Brookhaven National Lab.

THE USE OF RADIOCOBALT AS A SOURCE OF GAMMA RAYS AND SOME EFFECTS OF CHRONIC IRRADIATION ON GROWING PLANTS, by Arnold H. Sparrow and W. Ralph Singleton. [nd] 44p. (BNL-1188)

Radiocobalt was used as a source of γ rays in a study of the effect of chronic irradiation on growing plants. The installation and method of operation of sources of approximately 16 and 200 c are described. By placing plants in concentric circles around the sources at various distances it was possible to study the effects of a wide range of radiation intensities. Actual dosages varied from less than 0.1 r per day up to dosages in excess of 2000 r per day. The tolerance to ionizing radiation of different species of plants studied was found to vary widely. Preliminary tolerances are given for 19 different species of plants. Genetic, cytological, and morphological effects of chronic irradiation of plants are summarized.

5010

Brookhaven National Lab.

WEIGHT CHANGES AND WATER CONSUMPTION OF RATS EXPOSED TO WHOLE BODY X-IRRADIATION, by L. F. Nims and E. Sutton. [nd] 14p. (BNL-1190)

The weight changes and water consumption of young male rats after whole-body x irradiation were reexamined to determine whether they could serve as useful indices for biological dosimetry and also to gain additional information about the physiology of the radiation response. As a result of this study it was concluded that x irradiation does not greatly alter the over-all metabolism of the animal or the degree of hydration of the tissues. Fed irradiated rats lost weight for a period of time proportional to the dose received. The time required to regain the weight of the day of irradiation in 200-g rats was found to be a linear function of the dose up to 600 r. This index was reproducible enough to detect increments of 50 r in dose. Fed irradiated rats showed two periods of polydypsia, the first occurring within 24 hr after exposure and the second after 48 hr or longer, proportional to the dose received and associated with recovery and resumption of normal food intake and growth of the exposed animals.

5011

Atomic Energy Project, Univ. of Rochester

THE OCCURRENCE OF LYMPHOCYTES WITH BILOBED NUCLEI IN CYCLOTRON PERSONNEL, by M. Ingram, M. Adams, L. Coonan, J. Jespersen, G. Nielsen, D. Piatt, and G. Yettewich. June 16, 1952. 11p. (UR-211)

The incidence of lymphocytes with bilobed nuclei in the peripheral blood of cyclotron workers is reviewed for the period extending from late Fall, 1948, through 1951. Results are presented graphically. An increased incidence of binucleate lymphocytes occurred in the group as a whole during the first few months of cyclotron operation. After the completion of an earth and concrete dike between the cyclotron building and the cyclotron laboratory building the incidence of the abnormal cells returned to a level about equal to that for the control group. The significance of an increased incidence of binucleate lymphocytes in biological monitoring programs is discussed briefly. (auth)

5012

EFFECT OF CASTRATION ON THYROID REACTIONS FOLLOWING WHOLE-BODY IRRADIATION OF THE ORGANISM. H. Betz. Compt. rend. soc. biol. 146, 325-7 (1952) Feb. (In French)

It has been observed (Betz, Compt. rend. soc. biol. 146, 315(1952)) that rats x-irradiated with a sublethal dose of 500 r developed hyperactivity of the thyroid, whereas an 800-r dose resulted in hypoactivity. In the present experiment both male and female rats were castrated, then, after 5 or 15 days, whole-body irradiated with 500 r of 250-kv x rays. Five or 15 days after the irradiation the thyroids were removed and examined. Without regard to sex or to time separating castration and irradiation, the thyroids were found to be inactive. Examination of the testes and pituitaries of 800-r whole-body irradiated rats did not lead to a decision as to whether the thyroid hypoactivity observed in this case was caused by radiation castration. Male rats were x-irradiated with 800 r on the testes only, then, after 5 days, received a whole-body irradiation of 500 r. An obvious stimulation of thyroid activity was found, so the inhibition caused by 800 r cannot be due to radiation castration.

5013

EFFECT OF SURGICAL AND CHEMICAL THYROIDECTOMY ON HEMATOPOIETIC REGENERATION IN THE IRRADIATED RAT. H. Betz. Compt. rend. soc. biol. 146, 318-20(1952) Feb. (In French)

Surgical thyroidectomy on adult rats 6 days prior to a 500-r whole-body x irradiation did not change the regeneration picture in soft bone and spleen. Extreme inhibition, however, was noted in rats receiving thiourea (1% in feed)

for 15 days prior to irradiation and during the 6 or 16 days before the histological examination. A direct effect on the hematopoietic organs or perturbation of endocrine glands other than the thyroid are hypothesized to explain the action of the thiourea.

5014

STUDY OF THYROID MODIFICATIONS AFTER WHOLE-BODY IRRADIATION OF THE ORGANISM. H. Betz. Compt. rend. soc. biol. 146, 315-18(1952) Feb. (In French)

The completely different thyroid pictures developing in rats irradiated with a sublethal dose, 500 r, of 250-kv x rays and in those irradiated with a lethal dose, 800 r, are described. Hyperactivity in the first case is contrasted with hypoactivity in the second. Of rats irradiated with the 6- to 11-day LD_{50} dose (650 r), those that died exhibited thyroid hypoactivity, those that survived, hyperactivity. The author hypothesizes that, under lethal irradiation, all the secretory potential of the pituitary gland is used up in liberating the corticotropic principle (ACTH) to the detriment of the thyrotropic hormone.

5015

EFFECTS OF X RADIATION ON THE ORIGIN OF MALFORMATIONS IN HUMAN FETUSES. J. Pitter and J. Svejda. Ophthalmologica 123, 386-93(1952) June. (In German)

The case of a 2-yr-old girl whose mother was examined with x rays in the 4th, 5th, and 6th months of pregnancy for diagnostic purposes is described. The formation of various teratogenic peculiarities, microphthalmus, microcornea, syndactyly, brachydactyly, strabismus, hypermetropia, and amelogenesis and odontogenesis imperfecta, occurred. The article is introduced by a general account of the development of malformations, and similar cases from literature and experimental work are quoted. (auth)

5016

ROLE OF THYMONUCLEIC ACID IN THERAPY OF RADIATION LEUKOPENIAS. René Saracino. Semaine méd. (Paris) 28, 411-15(1952) May. (In French)

Several case histories and consideration of the literature prove that injection of a sodium salt of thymonucleic acid during x-ray therapy of malign tumors avoids or considerably reduces the appearance of leukopenia, and as a consequence permits uninterrupted local or general irradiation. The same considerations hold for teletherapy and radioisotope application. It appears possible to unite in a single syndrome the appearance of leukopenia and radioresistance.

5017

X-RAY-INDUCED MUTATIONS IN MICE. W. L. Russell. Cold Spring Harbor Symposia Quant. Biol. 16, 327-36(1951)

In an attempt to obtain information that would be useful in the estimation of the genetic hazards of ionizing radiation in man, wild-type male mice were exposed to a single dose of x rays and mated to a stock homozygous for seven autosomal recessive visible genes. Control, unexposed animals were also mated to the test stock. The offspring were observed carefully for mutations at the seven specific loci and cursorily for dominant visible mutations at any locus. Dominant mutations with obvious visible effects proved to be rare. Six have so far been found in the irradiated group and none in the controls. However, a dominant effect on size was found in about one half of the mutations at one of the specific loci. Approximately 61 mutations at the specific loci have been observed in the irradiated group, while only two were found in the control group. The frequencies of mutation at the seven loci in the irradiated group ranged from none at the the A locus to 28 or more at the S locus. Each of nine mutations in the irradiated group has now been tested for its phenotypic effect when homozygous. Two were found to be lethal, two sublethal and five viable. Three mutations to intermediate alleles were found in the irradiated group. Out of a total of eight mutations at either the D locus or the closely linked Se locus in the irradiated group, none showed a change at the associated locus. The mean observed mutation rate, for irradiated spermatogonia, at the seven loci is $25.0 \pm 3.7 \times 10^{-5}$ per roentgen, per locus. The rate is not appreciably dependent on the length of the interval between irradiation and fertilization. Comparison with similar data from Drosophila shows a higher induced mutation rate in the mouse. This indicates that estimates of human hazards based on Drosophila mutation rates may be too low. (auth)

5018

STUDIES ON THE MECHANISM OF REVERSION IN BIOCHEMICAL MUTANTS OF NEUROSPORA CRASSA. Norman H. Giles, Jr. Cold Spring Harbor Symposia Quant. Biol. 16, 283-313(1951) (cf. NSA 1-229)

Studies are reported on spontaneous and radiation-induced reversions in various nutritional mutants of Neurospora crassa. Initial comparative biochemical and genetic tests, experiments on x-ray-induced reverse-mutations, results of studies of spontaneous and induced reverse-mutability, and studies of crossing-over between certain alleles of mutants carrying genetic markers on opposite sides of an inositolless locus, are reported.

5019

EFFECTS OF DIETARY PROTEIN AND METHIONINE ON THE X-IRRADIATED RAT. Willie W. Smith, Isabelle B. Ackermann, and I. M. Alderman. Am. J. Physiol. 169, 491-98(1952) May.

Rats maintained before and after irradiation on diets containing 6 per cent casein showed a slightly higher incidence of death after irradiation with 550 r than did rats on 18 and 35 per cent casein diets. Reduction of the casein content of the diet after irradiation did not significantly alter 40-day mortality. When casein was increased to 60 per cent the observed mortality was somewhat reduced, but the difference was not statistically significant. Addition of methionine and cystine to the low casein diets did not influence the incidence of death. The effect of radiation on depression and recovery of leucocyte and erythrocyte production was not greatly influenced by diet, but a slight delay in reduction of circulating reticulocytes was observed in the 35 per cent casein diet group. The average rate of oxygen consumption by nembutalized rats on a 6 per cent casein diet was 12 per cent below, and on a 60 per cent casein diet 18 per cent above the value for rats on the 18 per cent casein diet. (auth)

5020

EFFECT OF EARLY CASTRATION AND OF X IRRADIATION ON THE DIFFERENTIATION OF SECONDARY SEXUAL CHARACTERISTICS IN XIPHOPHORES. Jean Vivien. Compt. rend. 234, 2394-5(1952) June 9. (In French; cf. NSA 5-2339)

It is possible to permanently sterilize prepuberal xiphophores fish with a 6000- to 8000-r x irradiation, the ensuing sexual differentiation being slightly retarded, but perfectly normal in both sexes. In the male, the testicle is reduced to interstitial tissue, forming eosiniphile islets between the deferent canaliculi, the active epithelium of which surrounds a dilated opening often filled with secretion. Analogous results have been obtained in Lebistes reticulatus after irradiation of the gonads. Comparison with effects of castration and treatment with crude extracts of normal or sterile gonads proves that development of secondary sexual characteristics is controlled by the interstitial gonad tissues. The prolonged complete sterility contradicts Essenberg's hypothesis that restitution of germinal cells in the Cyprinodontes may occur by development of the somatic cells of the peritoneal epithelium.

RADIATION HAZARDS AND PROTECTION

5021

Atomic Energy Research Establishment, Harwell, Berks (England)

THE REDUCTION OF RADIATION DOSE IN CHEST RADIOGRAPHY, by G. M. Ardran and H. E. Crooks. Apr. 25, 1952. 4p. (AERE MED/R-914)

Techniques are described which result in considerably reducing the radiation dose in x-ray examination of the chest. The importance of filtration of the primary x-ray beam is stressed and 3-mm Al or 2-mm Dural added filtration is recommended. Films taken with the methods described are said to have less contrast than when conventional techniques are used.

5022

Brookhaven National Lab.

THE BROOKHAVEN NATIONAL LABORATORY EMERGENCY RADIOLOGICAL MONITORING TEAM, by Lee Gemmell. [nd] 23p. (BNL-1189)

The equipment and organization of the Radiological Monitoring Team at Brookhaven are described. The team was set up under the AEC to provide emergency coverage for AEC sites in case of explosions or loss of fissionable material in transit, and to provide interim monitoring in case of an atomic disaster until such time as a civil defense organization could take care of its own monitoring needs.

5023

RADIOLOGICAL CONTAMINATION OF FOOD. I. G. Poppoff, G. W. Morrison, and F. R. Holden. Food Technol. 6, 278-80(1952) July.

Consideration is given to the contamination of food by radioactive particulate matter. Factors influencing the extent of such contamination and the conditions under which food may be safely salvaged are discussed.

5024

RADIUM HAZARD IN AN AIRCRAFT INSTRUMENT SHOP. R. K. Skow. Nucleonics 10, No. 3, 62-3(1952) Mar. (cf. NSA 5-6969)

Tests of radioactive contamination at the aircraft-instrument repair shop of the U. S. Naval Air Station at Alameda, Calif., show that tolerances prescribed by AEC for work with α emitters were being exceeded. The new control measures which were instituted successfully are described.

5025

EFFECT OF OXYGEN TENSION AND CERTAIN CHEMICALS ON THE X-RAY SENSITIVITY OF MUTATION PRODUCTION AND SURVIVAL. Alexander Hollaender, W. K. Baker, and E. H. Anderson. Cold Spring Harbor Symposia Quant. Biol. 16, 315-26(1951).

Recent studies of the effect of oxygen tension on x-ray sensitivity as measured by the lethal effects, chromosome changes, and mutations produced in E. coli, Drosophila, and Tradescantia are reviewed. Results of studies of the effects of chemicals, and the mechanisms which may be involved in the action of these chemicals in regard to x-ray sensitivity, are discussed. Compounds which were found to afford protection against radiation damage included strong reducing compounds, especially $Na_2S_2O_4$; glycerin, propylene glycol, triethylene glycol, and alcohols like methanol, ethanol, and propanol; carboxylic acids, and sulfhydryl-containing compounds.

5026

ACTIVITIES INDUCED IN COMMON FOODS BY THERMAL-NEUTRON EXPOSURE. Dorothy C. Peterson, S. H. Webster, and E. J. Liljegren. Nucleonics 10, No. 1, 33-6(1952) Jan.

Fifteen representative foods were subjected to irradiation by cyclotron neutrons moderated with ~4 in. of paraffin. Chemical analyses for Na, K, and P were made on duplicates of each food tested. It was found that in general it is possible to calculate neutron-induced radioactivities in foods from the Na, K, and P contents. However, other elements are sometimes present in sufficient concentrations to increase the activity significantly over that calculated. The radioactivity induced in foods at a distance of 1700 ft is so low that the ingestion of any reasonable amount will give a radiation dose that is insignificant compared to presently accepted tolerance doses.

5027

REMOVAL OF RADIOACTIVE WASTE FROM WATER. Conrad P. Straub. Nucleonics 10, No. 1, 40-4(1952) Jan. (cf. NSA 6-54)

The pilot plant for treatment of liquid radioactive wastes at ORNL is described. Experimental results obtained with this apparatus, together with additional techniques and procedures that have been applied successfully by others in the field, are given.

RADIATION SICKNESS

5028

EXPERIMENTAL STUDY OF ACUTE RADIATION SICKNESS IN THE DOG. Marquès, Puget, Bru, and Carrière. Rev. méd. vét. (new series) 15, 1-16(1952) Jan. (In French)

The symptomatology, blood picture, hemorrhagic syndrome, digestive disturbances, etc., of radiation sickness induced in 14 dogs of 6- to 15-kg weight and 1- to 10-yr age by whole-body exposure to 450 to 500 r of x radiation are presented.

RADIOGRAPHY

5029

HOW TO GET GOOD GROSS AUTORADIOGRAPHS OF LARGE UNDECALCIFIED BONES. W. E. Lotz, J. C. Gallimore, and George A. Boyd. Nucleonics 10, No. 3, 28-31(1952) Mar.

Apparatus and techniques for bone sectioning and autoradiographic exposure are described. 7 figures.

RADIOTHERAPY

5030

INTERNALLY ADMINISTERED ISOTOPES FOR CANCER THERAPY. Marshall Brucer. Nucleonics 10, No. 3, 46-51 (1952) Mar.

The current status of therapy with internally administered isotopes is summarized by means of abstracts of eight talks presented at the Symposium on Cancer Therapy with Radioisotopes which was held at the 1951 annual meeting of the American Association for the Advancement of Science.

5031

CAPSULES FOR ORAL ADMINISTRATION OF RADIOISOTOPES. Raymond L. Libby and Manuel Tubis. Nucleonics 10, No. 3, 63-4(1952) Mar.

The preparation, standardization, and thyroid uptake of radioiodine absorbed on anhydrous disodium phosphate in hard gelatin capsules are described.

5032

HANDLING OF RADIOACTIVE GOLD FOR THERAPEUTIC PURPOSES. Michel Ter-Pogossian and Alfred I. Sherman. Nucleonics 10, No. 3, 23-7(1952) Mar.

Laboratory instrumentation and methods which should be used in the therapeutic handling of Au^{198} are described. This paper traces the handling of the Au from the time of its purchase as a colloidal suspension ready for injection, through its dilution, transportation to the operating room, and injection. A final paragraph gives some rules for caring for the radioactive patient.

5033
ROOM-PROTECTION MEASUREMENTS FOR COBALT-60 TELETHERAPY UNITS. W. R. Dixon, C. Garrett, and A. Morrison. Nucleonics 10, No. 3, 42-5(1952) Mar.

Experimental measurements have been made of the attenuation of the direct beam in concrete and lead, of the intensity of radiation scattered from a phantom and a wall, and of the attenuation of the scattered radiation in concrete and lead for various angles of scatter. The measurements are described, and the results presented. From the data given, wall thicknesses sufficient to give proper protection can be calculated.

TOXICOLOGY STUDIES

5034
PARTIAL NEUTRALIZATION BY MAGNESIUM OF THE ACTION OF BERYLLIUM ON MITOSIS. H. Firket and M. Chèvremont. Compt. rend. soc. biol. 146, 310-12(1952) Feb. (In French)

Tissue explants were observed after being cultured in the presence of 0.0001M or 0.001M Be^{++} and 0.005M or 0.01M Mg^{++}, respectively, as to number of mitoses, proportions of phases, and inhibition of alkaline phosphatase. A certain degree of neutralization of the mitotic effects of Be was noted, which lends support to the hypothesis that Be acts by inhibition of an alkaline phosphatase.

5035
RADON IN NORMAL BREATH. E. J. Martin and J. K. W. Ferguson. Can. J. Med. Sci. 30, 42-7(1952) Feb.

When radon-free air is breathed prior to sampling, the amounts of radon in the expired air of normal subjects are considerably less than the amounts commonly found in "fresh" atmospheric air. The radon content of expired air of 15 normal men after breathing radon-free air for 10 min was found to be 1.5×10^{-14} curies per liter, with a standard error of 0.24×10^{-14} curies. The origin of radon in normal breath is discussed. (auth)

TRACER APPLICATIONS

5036
Harvard Medical School
METABOLISM OF C^{14}-LABELED GLYCEROL AND PYRUVATE BY LIVER IN VITRO, by Ching-Tseng Teng, Manfred L. Karnovsky, Bernard R. Landau, A. Baird Hastings and Frances B. Nesbett. [nd] 30p. (AECU-2125)

The metabolism of glycerol-$1C^{14}$ and pyruvate-$2C^{14}$ has been studied in liver slices from fasting, normal rats. About 86% of the glycercol metabolized was accounted for: 71% as glycogen and glucose, 5% as CO_2, 3% as lactate. The barium-precipitable and alcohol-insoluble fractions accounted for about 5% and the lipids, proteins, and ninhydrin-labile CO_2 accounted for about 4%. About 62% of the pyruvate metabolized was accounted for: 23% as glycogen and glucose, 16% as CO_2, 16% as lactate. The barium-precipitable and alcohol-insoluble fractions accounted for about 5% and the lipids, proteins and ninhydrin-labile CO_2 accounted for about 4%. When glycerol and pyruvate were present together as substrates, less pyruvate was converted to glycogen and CO_2, but the pyruvate reduced to lactate was doubled. The lactate formed has been degraded and the specific activities of the carbons determined. From these data the sources of the lactate carbons have been calculated. The significance of these interrelated metabolic reactions is discussed in terms of hydrogen transfer from glycerol to pyruvate. (auth)

5037
Argonne National Lab.
EFFECT OF GROWTH AND BODY SIZE ON FIXED CARBON TURNOVER, by Donald L. Buchanan and Akira Nakao. June 1952. 18p. (AECU-2138; UAC-594)

The effect of growth and animal size on fixed-C turnover was studied in rats, mice, and chick embryos constantly exposed to $C^{14}O_2$. As a result of this study it was concluded that protein turnover, rather than CO_2 fixation, determines the accumulation rate of fixed C in these species.

5038
RADIOACTIVE SUGARS. Atomics (London) 3, 181-4(1952) July.

The preparation of sugars and sugar derivatives, by the National Bureau of Standards, having radioactive carbon atoms located in specific positions within the molecule is described. Among those labeled sugars which have been prepared and are available for research workers in limited quantity are D-glucose, D-mannose, 1-C^{14}-labeled D-arabinose, D-ribose, D-galactose and lactose. Others shortly to be available are mannitol-1,6-C^{14}, D-fructose-1,6-C^{14}, D-arabinose-5-C^{14}, D-glucose-6-C^{14}, D-glucose-2-C^{14}, sorbitol-6-C^{14} and L-sorbose-6-C^{14}. The sugars are usually supplied at an activity level of about 1 μc/mg.

5039
METABOLIC PATHWAYS FROM TRACER EXPERIMENTS. Herman Branson. Arch. Biochem. Biophys. 36, 60-70 (1952) Mar.

Some metabolic pathways consistent with the findings of many tracer experiments where the data are presented as a series of exponential terms are presented. Specific examples for data on phosphorus metabolism in the rat liver are discussed in detail. The inability of existing tracer data to furnish sufficiently restrictive conditions is contrasted with the efficacy of such data in deciding against certain suggested interrelations. (auth)

5040
PERFECTION OF A "TRACE-HISTOPHOTOGRAPHIC" METHOD FOR CELLULAR REGISTRATION OF RADIOACTIVE ELEMENTS. Charles-Marie Gros, Pierre Cüer, and Roger Rechenmann. Compt. rend. 234, 2236-8(1952) May 26. (In French)

Observation and quantitative determination of radioactive elements in individual cells by the use of nuclear emulsion in which individual tracks are measured is described. As an example, the distribution of metabolized thorotrast (ThO_2) in liver cells is illustrated.

5041
THE DEPOSITION OF Sr^{89} IN RABBIT BONES FOLLOWING INTRAVENOUS INJECTION. Margaret Tutt, Barbara Kidman, Barbara Rayner, and Janet Vaughan. Brit. J. Expti. Path. 33, 207-15(1952) Apr.

The uptake by the skeleton of a single dose of Sr^{89} given by intravenous injection is extremely rapid; in young animals 70% of the injected Sr^{89} is present in the bone within 4 hours, with a consequent rapid lowering of the blood level. The fall in skeletal Sr^{89} follows a smooth curve for 9 days, reaching a figure of 55%. In older animals the uptake is equally rapid but reaches a lower maximum, and the curve for retention falls unevenly and to a greater extent in the first 9 days. In older animals retention is greater in the flat bones than in the long bones. This may be associated with the fact that in young animals there is red marrow throughout the shaft of the long bones, while in older animals there is more red marrow in the flat bones. There is no significant difference in retention in different long bones or different flat bones. In rabbits of 3 to 4 months the concentration of Sr^{89} is at first greater in the epiphyseal plate and later in the metaphysis; this displacement is evidently due to subsequent bone growth. The localized concentration of radioactive strontium within the bone must be remembered in considering toxic hazards. (auth)

CHEMISTRY

5042

Ames Lab.

INVESTIGATION OF THE OXIDIZED COMPLEXES OF NICKEL WITH VIC-DIOXIMES, by Charles V. Banks and Anton B. Carlson. July 23, 1952. 38p. (ISC-240)

This investigation has indicated that Ni–vic-dioxime complexes are examples of the stabilization of an unfamiliar oxidation state through complex formation. It is suggested that the unstable complex, usually prepared by bromine oxidation, exists in aqueous solution as the molecule, $Ni(DH)_3$, where DH represents the vic-dioxime anion formed by the loss of one oxime proton. The stable complex, usually prepared by peroxydisulfate ion oxidation, probably exists in aqueous solution as the ion, NiD_3^{--}, where D represents the vic-dioxime anion formed by the loss of both oxime protons. The results indicate that methods using these complexes for the spectrophotometric determination of Ni will remain empirical. 27 references.

5043

St. Olaf Coll.

PREPARATION AND PROPERTIES OF INORGANIC HYDRIDES; FINAL REPORT TO THE OFFICE OF NAVAL RESEARCH; JANUARY 1, 1950 THROUGH DECEMBER 31, 1951, by Albert E. Finholt. June 1, 1951. 7p. (NP-3932; U22525)

Mono-, di- and trimethyl germanes were prepared by the reaction between MeGe chlorides and $LiAlH_4$(I) (TIP U19026); these hydrides reacted slowly with and were insoluble in H_2O. Complex reactions occurring between $Ni(CO)_4$ and I depended on the relative proportion of the reagents. With an excess of I, the carbonyl groups apparently were converted to methoxy groups; for excess carbonyl, 1 mole of CO was evolved per mole of carbonyl reacting. Zr hydride was not isolated from the products of the reaction of $ZrCl_4$ and I. When a dilute solution of highly purified I was reacted with CO_2, HCOOH yields above 80% (depending upon the concentration and purity of I) were obtained with HCHO as the principle by-product. (NRS abst.)

5044

THE EXCHANGE OF VANADIUM(II) AND VANADIUM(III) IONS IN PERCHLORIC AND SULFURIC ACID SOLUTIONS. William R. King, Jr. and Clifford S. Garner. J. Am. Chem. Soc. 74, 3709-10(1952) July 20.

Rate of exchange in the vanadium(II)-vanadium(III) system in perchloric acid was measured with the aid of a separation based on α,α'-dypyridyl (dipy) and with a cation exchange resin separation. The exchange appears to be complete within the 1- to 5-min interval required to get the exchange mixture into the dipy reagent or onto the resin column. A check on the possibility indicated that the observed exchange was not primarily between tris-(dipy)-vanadium(II) and V(III) ions, but the possibility of rapid-separation induced exchange was not excluded.

5045

KINETICS AND SOME HYDROGEN ISOTOPE EFFECTS OF THE REACTION OF DIPHENYLDIAZOMETHANE WITH ACETIC ACID IN ETHANOL. John D. Roberts and Clare M. Regan. J. Am. Chem. Soc. 74, 3695-6(1952) July 20.

A table shows the rate of reaction at 30° of acetic acid with diphenyldiazomethane in C_2H_5OH and C_2H_5OD. Substitution of C_2H_5OD for C_2H_5OH caused a substantial decrease in the reaction rate. Use of CD_3COOD in the reaction did not alter the reactivity of the acetic acid much beyond the experimental error.

5046

EVIDENCE FOR THE EXCHANGE OF HYDROXYL RADICAL WITH WATER. Otto L. Forchheimer and Henry Taube. J. Am. Chem. Soc. 74, 3705-06(1952) July 20.

The reaction of H_2O_2 and O_3 produces a $1e^-$-oxidizing agent described as the hydroxyl radical which catalyzes the decomposition of O_3. When O_2 was contacted with O^{18}-enriched water, no exchange took place. Under the same conditions with H_2O_2 present about 10% of the oxygen in the gas exchanged. This experiment does not prove that the intermediate involved is OH^-, but provides strong evidence.

5047

ISOTOPIC EXCHANGE REACTIONS OF ZINC CHELATE COMPLEXES. Don C. Atkins, Jr. and Clifford S. Garner. J. Am. Chem. Soc. 74, 3527-9(1952) July 20.

The exchange of radiozinc between zinc acetate and seven zinc chelate complexes in pyridine has been investigated at 25°. The data indicate little or no exchange with zinc phthalocyanine, a "fused-ring" chelate complex, within a 35-day reaction time, reactants ca. 0.002 f each. The remaining zinc complexes, all of the "non-fused-ring" chelate type, undergo complete exchange within a 0.5-minute reaction time, reactants ca. 0.01 f each; the possibility that this rapid exchange was induced by the chemical separation of the reactants was not eliminated. This behavior is in agreement with the predictions of Ruben, Kamen, Allen and Nahinsky for exchange lability of metallo-organic complexes based upon structural properties. In pyridine the exchange lability appears to be greater for zinc salicylaldehyde derivatives than for the corresponding copper(II) and nickel(II) chelate complexes. (auth)

5048

PREPARATION OF CRYSTALLINE NITRIDES OF VANADIUM AND NIOBIUM. F. H. Pollard and G. W. A. Fowles. J. Chem. Soc., 2444-5(1952) June.

Critical conditions for preparation of crystalline VN and NbN on a hot filament in gaseous VCl_4 or $NbCl_5$ streams containing H_2 and N_2 are prescribed.

5049

BEHAVIOR OF POLONIUM OXYCHLORIDE IN VARIOUS ORGANIC SOLVENTS. G. Bouissières. Bull. soc. chim. France, 536-8(1952) May-June. (In French)

Evaporation to dryness of a HCl solution of Po gives a residue that dissolves readily in anhydrous ethyl alcohol, ethylene glycol, dioxane, acetone, methyl ethyl ketone, and acetylacetone, but is insoluble in chloroform or benzene. In ethyl alcohol or acetone solution Po deposits spontaneously on Ag, Ni, and Be with good yields. This compound, the properties of which clearly differ from those of the hydroxide, is probably an oxychloride.

ANALYTICAL PROCEDURES

5050

Atomic Energy Research Establishment, Harwell, Berks (England)

THE ANALYSIS OF URANIUM-TANTALUM AND URANIUM NIOBIUM ALLOYS, by G. W. C. Milner and A. J. Wood. Apr. 1, 1952. 15p. (AERE C/R-895)

Satisfactory procedures are described for the analysis of uranium-tantalum and uranium-niobium alloys containing up to 25% tantalum and niobium, respectively. They are based on the separation of the tantalum and niobium from uranium by extracting the fluorides of the former elements with methyl ethyl ketone. After the evaporation of the solvent from the combined organic extracts, the residue is ignited to about 800°C to yield the pentoxides of tantalum

and niobium. After the removal of the fluoride ions from the aqueous solutions, the uranium is determined by precipitation as ammonium diuranate and finally igniting to U_3O_8. Absorptiometric procedures are included for the determination of the trace amounts of unextracted tantalum and niobium. (auth)

5051

Bureau of Mines

VOLUMETRIC DETERMINATION OF SMALL QUANTITIES OF URANIUM WITH SPECIAL REFERENCE TO ERRORS ASSOCIATED WITH USE OF JONES REDUCTOR, by Claude W. Sill and Heber E. Peterson. June 1952. 26p. (BM-RI-4882)

Ferric sulfate is used to oxidize tetravalent U, permitting the titration to be made at room temperature with sulfatoceric acid in an essentially colorless solution. Ferroin, a very stable indicator, is used to give a sharp color change and exactly reproducible blanks. The effects of concentration of U, acidity, temperature, time, and catalysis on the air oxidation of tetravalent U are described. The air oxidation of tetravalent U induced by the air oxidation of substances unstable in air is shown. Procedures are described for the separation of essentially all interfering elements in amounts shown to cause interference.

5052

SEPARATION OF SMALL AMOUNTS OF THORIUM FROM THE CERITE EARTHS OF MONAZITE AND OTHER ELEMENTS; USE OF CINNAMIC ACID. K. V. S. Krishnamurty and Ch. Venkateswarlu. Rec. trav. chim. 71, 668-70(1952) June. (In English)

Cinnamic acid has been found to be a suitable reagent for the estimation and separation of small amounts of thorium from the cerite earths of monazite. The latter in concentration up to 2000-fold may be conveniently separated in a single precipitation. Using this reagent a separation from other common elements may also be effected. The presence of a little nitric acid (about 0.01N) in the wash liquid is found useful in giving the separation described, particularly when dealing with relatively large amounts of the cerite earths. (auth)

5053

VANILLIC ACID, A NEW REAGENT FOR THORIUM. K. V. S. Krishnamurty and A. Purushottam. Rec. trav. chim. 71, 671-5(1952) June. (In English)

Vanillic acid was found to precipitate Th quantitatively from solutions of pH 3.6. Ca, Sr, Ba, Mg, Zn, Cd, Ni, Co, Be, Al, and the rare earths did not interfere. The precipitate could be washed, ignited, and weighed as the oxide. Th in monazite can be conveniently estimated in a single precipitation.

5054

VOLUMETRIC DETERMINATION OF MILLIGRAM QUANTITIES OF URANIUM. Claude W. Sill and Heber E. Peterson. Anal. Chem. 24, 1175-82(1952) July.

Titration procedures with both a Jones reductor and a Pb reductor are described. Separations are given for essentially all interfering elements. The sources and extent of errors produced are discussed. The method is designed to cover the intermediate range with greatest accuracy, but is also applicable to larger quantities. The accuracy attainable ranges from about 2% with 1 mg of U to within ±0.1% with 20 mg or more.

5055

COLORIMETRIC DETERMINATION OF NIOBIUM USING THIOCYANATE. Allen B. H. Lauw-Zecha, Samuel S. Lord, Jr., and David N. Hume. Anal. Chem. 24, 1169-73(1952) July.

Microgram quantities of Nb were determined by treating the sample in hydrochloric or tartaric acid with $SnCl_2$ and KSCN, extracting the resulting yellow complex in ether, and measuring the absorbancy at 385 mμ with a Beckman DU spectrophotometer. Optimum conditions for the determination are described. Metals which interfere with the method, if present in a tenfold excess, are U, V, W, and Mo. The method appears to be the most sensitive and satisfactory yet reported for determination of μg quantities of Nb.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5056

THE POWDER DIFFRACTION INTENSITIES OF GRAPHITE FOR X-RAYS AND NEUTRONS. G. E. Bacon. Acta Cryst. 5, 492-9(1952) July.

Measurements are reported of the powder-diffraction intensities of graphite for both x rays and neutrons, with due allowance for crystallite orientation, thermal vibrations, and the rhombohedral modification. The neutron intensities agree with those calculated from the Bernal structure to within 5%, thus showing that discrepancies in x-ray intensities must be mainly due to the inadequacy of the James and Brindley f curve. Comparison with the curve given by McWeeny (Acta Cryst. 4, 513(1951)) suggests a certain, but only small, asymmetry of electron distribution. The neutron intensities, although confirming the Bernal method of layer stacking, cannot decide for or against Lukesh's (Phys. Rev. 80, 226(1950)) proposed slight distortion of the carbon hexagons. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

5057

INFRARED SPECTRUM AT HIGH DISPERSION OF CH_2=CHD. I. C. Courtoy and M. de Hemptinne. Ann. soc. sci. Bruxelles. Sér. I. 66, 82-110(1952) June 25. (In French)

The infrared absorption spectrum of CH_2=CHD, taken with high dispersion, has been analyzed between 750 and 3207 cm^{-1}. A large part of the absorption curves are presented on plates, and tables list the absorption maxima, reduced to vacuum. Band heads and certain fine structures are interpreted.

5058

REMARKS ON THE KINETIC THEORY PROPOSED BY DARMOIS AND SUTRA TO EXPLAIN THE OBSERVED VALUE OF THE RATIO OF MOBILITIES OF ELECTROLYTIC H^+ AND D^+ IONS. Talat-Erben. J. chim. phys. 49, 273-4(1952) May. (In French)

The theory referred to treats the H^+ and D^+ ions in solution as free protons and deuterons and calculates their mobility ratio in a manner analogous to that used for electron conductivity in metals. The great difference between the mass ratios electron/atom and H^+/H_2O or D^+/D_2O throws doubt on this analogy. A value of 1.367 is calculated for the mobility ratio of H^+ in H_2O and D^+ in D_2O by considering the exact velocity persistence. Mutually compensating errors in the calculation of Darmois and Sutra are pointed out, and degree of hydration of the ions is discussed.

5059

HYDROGEN EXCHANGE AND ISOMERIZATION OF SATURATED HYDROCARBONS WITH SULFURIC ACID. D. P. Stevenson, C. D. Wagner, O. Beeck, and J. W. Otvos. J. Am. Chem. Soc. 74, 3269-82(1952) July 5.

Isomerization and hydrogen exchange reactions of saturated hydrocarbons with sulfuric acid have been studied using deuterium as a tracer and the mass spectrometer as the analytical tool. These reactions are interpreted as occurring by means of an ionic chain. The reactions observed are considered to be the reactions of the ions. The probability that an ion will isomerize or will undergo hydrogen exchange is determined by the rates of such reactions relative to the rate

of reconversion of the ion to the hydrocarbon. Only isoparaffins (defined as saturated hydrocarbons with tertiary carbon atoms) undergo any observable reaction, and only isoparaffins are formed as a result of isomerization. The isoparaffin products invariably contain methyl groups attached to the tertiary carbon. The hydrogen atoms exchanging with sulfuric acid always include at least those attached to carbon atoms adjacent to the tertiary carbon. The exchange of others more distant from the tertiary carbon appears to result from isomerization of the ion, and the pattern of such exchange depends upon the molecular structure and, to some extent, upon reaction conditions. With certain isoparaffins all but one of the hydrogen atoms in the molecule invariably exchange with acid, and a study of the mass spectrum of the C_nHD_{2n+1} species furnishes a direct method for the determination of the relative rate of production from the activated state of all isomers, including the species with the same carbon skeleton as the reactant. Results of this work provide an explanation for the facts that only isoparaffins react and only isoparaffins are produced in the sulfuric acid-catalyzed alkylation reaction. The results also demonstrate that the carbonium ions are true intermediates with finite lifetimes, and that their mode of reaction depends upon the degree of their activation. (auth)

FLUORINE AND FLUORINE COMPOUNDS

5060

THE EFFECT OF FLUORINE ON PRASEODYMIUM TRIFLUORIDE. Theodore P. Perros and Charles R. Naeser. J. Am. Chem. Soc. 74, 3694-5(1952) July 20.

Praseodymium trifluoride was reacted with F_2 at temperatures from 300 to 800°C for periods of 3 to 8 hr. After each run, tests to determine whether any oxidation had occurred gave negative results.

5061

PREPARATION AND PHYSICAL PROPERTIES OF NIOBIUM PENTAFLUORIDE. J. H. Junkins, R. L. Farrar, Jr., E. J. Barber, and H. A. Bernhardt. J. Am. Chem. Soc. 74, 3464-6 (1952) July 20.

Niobium pentafluoride was prepared by fluorinating the metal with elemental fluorine at 300°. The melting point was found to be 78.9 ± 0.2°, the boiling point 233.3 ± 0.5°, and the heat of fusion was estimated to be 8600 cal/mole. A sample of the compound was distilled in a 20-plate column. The vapor pressure of the middle fraction was measured and expressed by an equation. The liquid density was measured in the range of 86 to 125° and expressed by an equation. The following thermodynamic quantities for the vaporization process were calculated from the vapor pressure data and corrected for deviation from ideality by the density measurements: $\Delta C_p = -8.5$ cal/deg/mole; $\Delta H_v = 16{,}800 - 8.5\ T$; $\Delta S_v = (16{,}800/T) - 8.5$. The compound was found to be more stable toward hydrolysis than either ruthenium pentafluoride or uranium hexafluoride. There was no evidence of decomposition of niobium pentafluoride at temperatures up to 255°. (auth)

LABORATORIES AND EQUIPMENT

5062

Pittsburgh Univ.

A CONVENIENT APPARATUS FOR THE DISTILLATION OF SOLIDS, by Lloyd B. Barkley, James K. Sneed, Thomas F. McGrath, and Robert Levine. Issued July 14, 1952. 3p. (NYO-3378)

An apparatus is very briefly described for the distillation of solids or mixtures of solids which melt at 45 to 50°C or higher and crystallize easily on distillation. The apparatus prevents the materials from solidifying in and clogging the side-arm of the equipment.

5063

TOOLS FOR DISMANTLING CONTAMINATED CELLS. A. M. Tripp and Frank Ring, Jr. Nucleonics 10, No. 7, 68, 70(1952) July.

A long arm of Al tubing, to the end of which various tools could be attached, was constructed. For nut and bolt turning, a Piezo Universal Gear Joint and a wrench socket were attached to the arm. A saw and vise combination to be attached to the same arm is described for disassembling welded and corroded sections. Both tools can be operated at distances 27 ft below or 15 ft horizontally from the operation.

5064

REMOTE PIPETTE CONTROL FOR RADIOACTIVE LIQUIDS. Ervin J. Liljegren and Stewart H. Webster. Nucleonics 10, No. 7, 67-8(1952) July.

This arrangement consists of a hypodermic syringe mounted in a holder containing a coarse rack and pinion assembly taken from a microscope. The syringe, connected with a pipette by means of a rubber tube, serves to fill and adjust the liquid level in the pipette, only the latter coming in contact with the radioactive material. By means of adapters and washers the holder can be made to accommodate 28 0.01 to 28 cc of liquid. Measurements made with the pipette control 4 ft. from the pipette and with a telescope for reading the meniscus had a mean deviation of 0.0015 ml.

MOLECULAR STRUCTURE

5065

Gates and Crellin Labs. of Chemistry, Calif. Inst. of Tech.

INVESTIGATIONS OF THE MOLECULAR STRUCTURES OF CERTAIN COMPOUNDS OF BORON BY THE METHOD OF ELECTRON DIFFRACTION, by Kenneth Hedberg and Verner Schomaker. June 15, 1952. 35p. (NP-3940; Technical Report No. 3; U22598)

An Electron Diffraction Investigation of the Structures of the Aminodiboranes $(CH_3)_2NB_2H_5$ and $H_2NB_2H_5$: This section comprises a reprint from J. Am. Chem. Soc. 74, 954(1952). Bonding in electron-deficient B compounds: An extension of Pauling's concept of metallic bonding (Proc. Roy. Soc. (London), A196, 343(1949)) satisfactorily correlated bond distances and indicated a relationship between typical electron-deficient bonding and metallic bonding. The large deviations which occurred in calculating the B radius in AlB_2, ZrB_2, CaB_6, and ErB_6 were attributed to the crystal structures of the compounds. Consistent values were obtained from compounds in which B had a high ligancy (5 or 6). The Born approximation in electron diffraction: The first Born approximation failed to give the phase shift on scattering shown by electron-diffraction data for UF_6 and other gas molecules of the MX_n type. The shift was approximately proportional to atomic number, depended on the angle of scattering, and could become large. Preliminary estimates of the phase shifts were made by evaluating the second Born approximation for exponential screening. Crystal structure of MgB_2: Commercial powdered B was heated with Mg in an amount exceeding that required by the stoichiometry of Mg_3B_2 in an MgO-coated Fe crucible to about 800°C for 1 hr. Resultant cell parameters (a_0 = 3.0834 ± 0.0003 A and c_0 = 3.5213 ± 0.0006 A) indicated a cell too small to contain 3 Mg and 2 B atoms; density data established the compound as MgB_2. Powder photographs of the products obtained from the reaction of Mg with B_2O_3 by the Stock method (Hydrides of Boron and Silicon, p. 28, Cornell Univ. Press, 1933) indicated the presence of MgB_2 rather than Mg_3B_2. (NRS abst.)

RADIATION EFFECTS

5066

RADIOCHEMICAL REACTIONS IN NUCLEAR REACTIONS. II. EFFECT OF ELECTROLYTES ON THE FORMATION

AND DECOMPOSITION OF HYDROGEN PEROXIDE. M. Haïssinsky and J. Pucheault. J. chim. phys. 49, 294-301 (1952) May. (In French)

The formation and decomposition of H_2O_2 in aqueous solution by the direct radiation of the Châtillon pile and by the H^3, He^4, and Li^7 recoils produced by neutron reactions on Li and B have been studied. Kinetic effects of various electrolytes (LiOH, $LiClO_4$, NaH_2PO_4, Li_2SO_4, $MgSO_4$, etc.) are significant; their variation with nature of electrolyte, concentration, and pH is discussed. The results are confirmed in part by experiments on radiation effects of Rn α particles. Studies on the reduction of ceric sulfate by He^4 + Li^7 recoils in boric acid solution also are reported.

5067

RADIOCHEMICAL REACTIONS IN NUCLEAR REACTORS. I. FORMATION OF HYDROGEN PEROXIDE BY IRRADIATION OF BORIC ACID SOLUTIONS. J. Pucheault, M. Lefort, and M. Haïssinsky. J. chim. phys. 49, 286-93(1952) May. (In French)

The formation of H_2O_2 in aqueous boric acid solutions irradiated with α particles and Li^7 recoil atoms from the $B^{10}(n,\alpha)$ reaction is accompanied by partial decomposition of the H_2O_2 by the direct pile radiation. A procedure by which this effect can be calculated, thus giving reproducible and coherent experimental results, is presented. In 0.8N H_2SO_4 or in alkaline solution, the quantity x of H_2O_2 formed is proportional to time and radiation intensity; the yield is below that given by Rn α particles. In the intermediate pH range (3 to 7), x is still proportional to time, but tends with increasing intensity I to a limit $x = kIt/(1 + k'I)$. For relatively short-time and high-intensity radiation, x is greater than calculated by this equation. Interruption of the irradiation even for a short time may, under certain conditions, lead to a greater formation of H_2O_2 than that obtained during an equal period of uninterrupted irradiation. Addition of H_2O_2 to the solution before the irradiation has no effect on the quantity of H_2O_2 produced. In order to interpret these observations, the authors assume the formation under irradiation of a H_2BO_2 radical and unstable H_3BO_4 in acid solution. In addition, the formation of H_2O_2 seems to be controlled by the transformations produced along the α and Li^7 tracks.

SEPARATION PROCEDURES

5068

A METHOD FOR THE SEPARATION OF RARE EARTHS AND ITS APPLICATION TO OTHER ELEMENTS. L. Hufferman. Chem. Weekblad 48, 441-5(1952) June 21. (In Dutch)

The more important methods of separating and purifying rare earths are surveyed briefly. Trombe's method (Compt. rend. 215, 539(1942); 216, 888(1943); 225, 1156(1947)) of fractional precipitation with gaseous NH_3 in basic solution is described in somewhat more detail. The possibility of applying this method to the separation of other elements, specifically, Fe or Zn from Al, is discussed. 32 references.

5069

PRODUCTION OF LANTHANON AND THORIUM COMPOUNDS FROM MONAZITE. II. E. S. Pilkington and A. W. Wylie. J. Applied Chem. 2, 265-73(1952) May.

A partly cyclic process is described for the separation of the mixed hydroxides of the cerium-group elements into cerous salts and into concentrates containing, respectively, lanthanum salts, mixed praseodymium-neodymium-samarium hydroxides or nitrates, and crude thorium phosphate. The mixed hydroxides of praseodymium, neodymium and samarium are fractionally precipitated with ammonium hydroxide, leaving lanthanum in solution. A portion of the praseodymium, neodymium and samarium concentrate is used to precipitate basic salts of ceric cerium and thorium, the remainder being recovered. Cerium is obtained from the mixture of basic salts by reducing ceric compounds to the cerous state and precipitating thorium as a basic salt. Lanthanum is finally precipitated as lanthanum oxalate or lanthanum carbonate and cerium as sodium cerium sulphate. Electrometric titrations of lanthanon solutions have been made at 80° to obtain data facilitating control of the various separations. (auth)

5070

THE SEPARATION OF QUADRIVALENT AND QUINQUEVALENT VANADIUM FROM PHOSPHORIC ACID BY ION-EXCHANGE RESINS: SOME OBSERVATIONS ON THE REDUCTION OF QUINQUEVALENT VANADIUM BY ION-EXCHANGE RESINS. J. E. Salmon and H. R. Tietze. J. Chem. Soc., 2324-6(1952) June.

By use of cation-exchange resins, V, in both the quadrivalent and the quinquevalent state, has been separated from phosphoric acid solutions. The adsorption of quinquevalent V was accompanied by a partial or even complete reduction to the quadrivalent state. (auth)

5071

INORGANIC CHROMATOGRAPHY ON CELLULOSE. PART VIII. THE USE OF A "COMPOUND" COLUMN OF ALUMINA AND CELLULOSE FOR THE DETERMINATION OF URANIUM IN MINERALS AND ORES CONTAINING ARSENIC AND MOLYBDENUM. W. Ryan and A. F. Williams. Analyst 77, 293-6(1952) June.

A new technique in inorganic chromatography, with alumina and cellulose adsorbents in the same extraction column, is described for the separation of uranium from minerals and ores. The purpose of the alumina is to retain arsenic and molybdenum, which are not readily retained by cellulose alone when ether containing 5% v/v of concentrated nitric acid, sp.gr. 1.42, is used as the extraction solvent. (auth)

5072

INORGANIC CHROMATOGRAPHY ON CELLULOSE. PART IX. THE USE OF ALUMINA AND CELLULOSE ADSORBENTS FOR THE DETERMINATION OF THORIUM AND THE SIMULTANEOUS DETERMINATION OF THORIUM AND URANIUM IN MINERALS AND ORES. A. F. Williams. Analyst 77, 297-306(1952) June.

A method is described for the chromatographic separation of thorium from minerals and ores. Its application to the quantitative determination of this element in macro and micro amounts is described. The method can be applied to simple minerals such as monazite and to complex materials such as samarskite and pyrochlore, which are very difficult to analyze by the classical analytical procedures. Alumina is used as the principal adsorbent. Although thorium nitrate cannot be extracted from a cellulose adsorbent in the presence of phosphate ion by ether containing nitric acid, an extraction can be made from an alumina adsorbent. By the use of cellulose beneath the alumina, thorium nitrate can be extracted free from other ions. The method has been extended to the chromatographic determination of uranium and thorium in the same sample of material. (auth)

5073

INORGANIC CHROMATOGRAPHY ON CELLULOSE. PART X. THE SPECTROGRAPHIC DETERMINATION OF MICRO QUANTITIES OF THORIUM SEPARATED BY CHROMATOGRAPHY FROM MINERALS AND ORES. G. W. J. Kingsbury and R. B. F. Temple. Analyst 77, 307-12(1952) June.

A simple spectrochemical method is described for the determination of micro quantities of thorium separated by chromatographic methods from small samples of about 1 g of minerals and ores. The extracted thoria is co-precipitated with lanthanum, which forms the matrix and acts as internal standard in the spectrographic analysis. The spectrochemical procedure alone has a standard deviation of ±3% and has been operated for ore concentrations between

0.001 and 0.2% of thoria, only 1 g of the original material being used. For concentrations above 0.2% of thoria, the amount of ore necessary is considerably reduced. (auth)

SPECTROSCOPY

5074

Ames Lab.

EXCITATION STAND FOR SPECTROGRAPHIC ANALYSIS; A NEW DESIGN, by John Weber, Jr., Robert H. Heidel, Paul W. Kehres, Harold D. Cook and Velmer A. Fassel. [nd] 16p. (ISC-239)

The excitation stand described differs from conventional models in the orientation of the electrode jaw system and in the use of a novel kinematic linkage for operation of the electrode jaws. The symmetrical action of the jaw system will support electrodes varying in diameter from ⅛ in. to ⅜ in. in self-centered alignment. Since the electrode control and adjustment system, the electrode water-cooling system, and the electrical terminals are isolated from the oxidation chamber, cleaning and decontamination is facilitated and corrosion of gears and electrical contacts is retarded. In contrast with conventional electrode holder design, the jaws are mounted in a direction toward the operator rather than toward the spectrograph. A viewing system has been added which permits the observation of the electrical discharge under variable intensity conditions. The design and construction are described in detail, and diagrams are shown. 26 references.

SYNTHESES

5075

Los Alamos Scientific Lab.

MICRO SYNTHESES WITH TRACER ELEMENTS. XXXII. A. THE SYNTHESIS OF TRITIUM LABELED SUCCINIC ACID (BUTANEDIOIC-2,2,3,3,-H_4^3 ACID) AND Di-N-ETHYLENE-SUCCINAMIDE; B. THE SYNTHESIS OF DEUTERIUM LABELED SUCCINIC ACID (BUTANEDIOIC-2,2,3,3-H_4^3 ACID), by D. Lloyd Williams and Anthony R. Ronzio. [nd] 16p. (AECU-2126; LADC-1218)

Dicarboxymethylacetylene was tritiated to dimethyl succinate in 4 to 6 hr with a Pd catalyst. The dimethyl ester was hydrolyzed with 10% NaOH to obtain succinic acid which was then converted to the anhydride. On addition of thionyl chloride with a small amount of anhydrous zinc chloride and upon heating for 12 hr at 120°C succinyl chloride was obtained. The chloride was condensed with ethylenimine to di-N-ethylenesuccinamide. The synthesis of H^2-labeled succinic acid proceeded in essentially the same manner as described above for the case of H^3-labeled succinic acid.

5076

PREPARATION OF RADIOACTIVE PENICILLIN. E. Lester Smith and D. J. D. Hockenhull. J. Applied Chem. 2, 287-8 (1952) May.

Crystalline radioactive penicillin has been prepared biosynthetically with a specific activity of over one curie per gram. A synthetic medium low in sulphur and containing 1 mc/ml of $Na_2{}^{35}SO_4$ was fermented in shake flasks. The penicillin was purified by solvent extraction and crystallized as the N-ethylpiperidine salt. (auth)

5077

MICROSYNTHESES UTILIZING C^{13} OR C^{14}. III. PREPARATION OF FORMALDEHYDE BY DECOMPOSITION OF 2,2,2-TRIPHENYLETHANOL. L. Pichat and M. Audinot. Bull. soc. chim. France, 466-7(1952) May-June. (In French)

The method given by Brown (Nucleonics 1, 21(1947) Nov.) for synthesis of HC*HO by thermal decomposition of triphenylethanol, prepared by $LiAlH_4$ reduction of triphenylacetyl chloride, has been investigated with respect to conditions of the decomposition with and without catalysts. Yields >10% based on the starting material, C^*O_2, have been obtained.

5078

SEMIMICROSYNTHESIS OF ACETIC ACID OF HIGH SPECIFIC ACTIVITY LABELED WITH C^{14} IN THE CARBOXYL GROUP. Roland Muxart, Pascaline Daudel, Claude Rigolet, and Robert Melet. Bull. soc. chim, France, 577-80(1952) May-June. (In French)

The method of Van Bruggen et al. (Nucleonics 7, No. 3, 45(1952)) for production of carboxyl-labeled Na acetate has been combined with the method of Spector and Lemmon (Isotopic Carbon, New York, Wiley, 1949, p.178) for conversion of the acetate to acid and has been adapted to the semimicro scale. Specific activity obtained was 4 mc/mmole in 60% yield with respect to BaC^*O_3.

5079

SYNTHESIS OF FUMARIC ACID-2-C^{14} AND MALEIC ANHYDRIDE-2-C^{14}. Robert F. Nystrom, Y. H. Loo, and John C. Leak. J. Am. Chem. Soc. 74, 3434-35(1952) July 5.

Fumaric acid-2-C^{14} is prepared by the conversion of $C^{14}O_2$ to methylene-labeled succinic acid, dibromination of succinic acid-2-C^{14} and reaction of meso-dibromosuccinic acid-2-C^{14} with an acetone solution of NaI to furnish fumaric acid-2-C^{14}. Maleic anhydride-2-C^{14} is obtained from fumaric acid-2-C^{14} and PO_5 in 96% yield.

5080

STRUCTURAL CHEMISTRY OF THE ALKOXIDES. PART I. AMYLOXIDES OF SILICON, TITANIUM, AND ZIRCONIUM. D. C. Bradley, R. C. Mehrotra, and W. Wardlaw. J. Chem. Soc., 2027-32(1952) June.

The isomeric amyloxides $M(OC_5H_{11})_4$ and other alkoxides of Ti and Zr have been prepared by alcoholysis. Boiling points (under reduced pressure) and molecular weights of these compounds and of n-amyl and neopentyl orthosilicates have been measured. The influence of branching of the amyl group on the physical properties of these compounds is discussed. (auth)

5081

THE PREPARATION OF ZIRCONIUM ALKOXIDES. D. C. Bradley, F. M. Abd-el Halim, E. A. Sadek, and W. Wardlaw. J. Chem. Soc., 2032-5(1952) June.

The preparation of $(C_5H_6N)_2ZrCl_6$ (C_5H_6N = pyridinium) from zirconyl chloride or Zr tetrachloride is described. The Zr alkoxides $Zr(OR)_4$, where R = Et, Pr^i, Bu^s, and Bu^n, were prepared by treatment of $(C_5H_6N)_2ZrCl_6$ and the alcohol (ROH) with ammonia in benzene. The complex Zr chloride reacted with tert-butyl alcohol and ammonia in pyridine and gave $ZrCl(OBu^t)_3.2C_5H_5N$. This compound was converted into the mixed alkoxide $Zr(OEt)(OBu^t)_3$ which disproportionated when heated, to give Zr tetra-tert-butoxide. $(C_5H_6N)_2Zr(OEt)Cl_5$ was obtained from the reaction between sodium ethoxide and $(C_5H_6N)_2ZrCl_6$. (auth)

5082

MICROSYNTHESIS OF RADIOBROMOTRIPHENYLETHYLENE. S. Apelgot, A. Cheutin, S. Mars, and M. R. Berger. Bull. soc. chim. France, 533-5(1952) May-June. (In French)

Br^{82}-labeled bromotriphenylethylene was prepared in 98% purity and 3100-counts/min/μg specific activity by the reaction of triphenylethylene with Br_2 in air-free chloroform in a N_2 atmosphere. Ultraviolet absorption spectra of triphenylethylene, triphenylethanone, and bromotriphenylethylene are shown.

5083

A PORPHYRIN WITH RADIOACTIVE IODINE. Alfred Treibs. Naturwissenschaften 39, 281(1952) June. (In German)

Synthesis of I^{131}-labeled dimethyl ester of diiododeuteroporphyrin by elimination of Fe and the vinyl groups from hemin followed by prolonged heating with I and pyridine is mentioned briefly. The labeled product is to be used as a tumor diagnostic agent.

TRACER APPLICATIONS

5084

RADIOACTIVE-TRACER TECHNIQUES IN PAPER CHROMATOGRAPHY. F. P. W. Winteringham, A. Harrison, and R. G. Bridges. Nucleonics 10, No. 3, 52-7(1952) Mar.

The application of radiotracer techniques to paper chromatography may permit the separated components not only to be located and characterized but to be estimated quantitatively. The principle is to associate one or more suitable radioisotopes with one or more of the components of the mixture, either before or after chromatography. The components separated on the chromatogram are then located and estimated by their associated radioactivity. Three methods of associating the isotope with one or more bands of the resolved components of the chromatogram are described, as follows: labeling of mixture before paper chromatography, treatment of chromatogram with labeled reagent, and neutron activation of the chromatogram. Diagrams are presented of a device which automatically scans the chromatogram. Methods of quantitative interpretation of the results and necessary corrections are discussed.

URANIUM AND URANIUM COMPOUNDS

5085

PREPARATION AND ABSORPTION SPECTRA OF SEVERAL URANIUM HALOGENIDES. I. R. Rohmer, R. Freymann, Mme. R. Freymann, A. Chevet, and P. Hamon. Bull. soc. chim. France, 598-603(1952) May-June. (In French)

Details of the preparation of pure UCl_4, UCl_5, UCl_3, UBr_4, and UO_2Cl_2 to be used in a study of absorption spectra and fundamental frequencies are reported.

5086

ABSORPTION SPECTRA OF URANIUM HALOGENIDES. II. R. Rohmer, R. Freymann, Mme. R. Freymann, A. Chevet, and P. Hamon. Bull. soc. chim. France, 603-11(1952) May-June. (In French)

Visible and near-infrared absorption spectra of UCl_4, UCl_5, UCl_3, UBr_4, and UO_2Cl_2, as determined in the solid state at –183°C and in aqueous solution, are presented. The absorption spectra of UCl_4 in acetone, ethyl acetate, and absolute ethanol also are given. The absorption bands are classified, and molecular-vibration frequencies are assigned. 79 references.

5087

PREPARATION AND PROPERTIES OF URANYL CARBONATES. II. ALKALINE EARTH URANYL CARBONATES. M. Bachelet, E. Cheylan, M. Douis, and J. C. Goulette. Bull. soc. chim. France, 565-9(1952) May-June. (In French)

Compounds having the general formula $[UO_2(CO_3)_3]M_2$ and $[(UO_2)_2(CO_3)_5]M_3$, where M represents Mg, Ca, Sr, or Ba, were prepared by double decomposition in H_2O and, in most cases, isolated. Solubilities in H_2O were measured. The compounds were readily hydrolyzed, and the majority were fluorescent under ultraviolet light. No indication of the formation of Be salts could be found.

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

5088

Knolls Atomic Power Lab.

DISCUSSION OF PAPER, [ON] HEAT EXCHANGER TUBE SHEET DESIGN, by G. Horvay. [nd] 6p. (AECU-2133)

Mathematical analysis is made of deflection in perforated tube sheets.

5089

Lewis Flight Propulsion Lab., NACA

EXPERIMENTAL INVESTIGATION OF AVERAGE HEAT-TRANSFER AND FRICTION COEFFICIENTS FOR AIR FLOWING IN CIRCULAR TUBES HAVING SQUARE-THREAD-TYPE ROUGHNESS, by Eldon W. Sams. June 27, 1952. 43p. (NACA-RM-E52D17)

A heat-transfer investigation was conducted with air flowing through electrically heated inconel tubes having various degrees of square-thread-type roughness (conventional roughness ratios of 0 (smooth tube), 0.016, 0.025, and 0.037), an inside diameter of ½ inch, and a length of 24 inches over ranges of bulk Reynolds number up to 350,000 and average inside-tube-wall temperatures up to 1950°R. The data showed that both heat transfer and friction increased with increase in surface roughness (particularly at the higher Reynolds numbers) and were also influenced by tube wall-to-bulk temperature ratio. Good correlation of the heat-transfer data for all tubes was obtained by use of a modified Reynolds number including the friction velocity. Correlation of the friction data for the rough tubes was obtained for the complete turbulence region by use of a modified correlation incorporating a roughness parameter which excludes the conventional roughness ratio; no over-all correlation was obtained for the region of incomplete turbulence. (NACA abst.)

5090

Columbia Univ.

BOILING AND CONDENSING OF LIQUID METALS; PROGRESS REPORT, by C. F. Bonilla, J. S. Busch, H. T. Chu and B. Misra. Apr. 24, 1952. 12p. (NYO-3148)

Preliminary data have been obtained on the boiling at atmospheric pressure of a shallow layer of Hg on a horizontal iron-plated surface. The boiling film coefficient of heat transfer, h, ranged from 1600 to 8400 Btu/hr × ft² × °F. No film boiling was observed although a heat flow rate of 260,000 Btu/hr × ft² was reached. Hg vapor at atmospheric pressure was condensed on a short water-cooled vertical iron tube. Dropwise condensation was obtained, but seemed to impair the heat transfer, if anything, on account of the adherence of the droplets to the surface. Droplets ranged from 1 mm in diameter down to dust, and at intervals a slide would occur of all of the droplets on a given area. The condensing film heat transfer coefficients were very low, ranging from 220 to 530 Btu/hr × ft² × °F. They were apparently adversely affected by a mercury oxide film that built up on the surface, and/or by traces of noncondensable gas. More reliable data on the thermoelectric force of the thermocouple Fe-Hg have been obtained, which are approximately 10% higher than the previous results. The millivolts of a couple with its cold junction at 0°C and hot junction at t°C is given, up to about 400°C, by $E = 0.01939\,t - 8.834 \times 10^{-6}t^2 - 9.675 \times 10^{-9}t^3$. (auth)

5091

[Aircraft Nuclear Propulsion Project]

FORCED CONVECTION HEAT TRANSFER IN A PIPE SYSTEM WITH VOLUME HEAT SOURCES WITHIN THE FLUIDS, by H. F. Poppendiek and L. Palmer. Nov. 20, 1951. 18p. (Y-F30-3)

TRACER APPLICATIONS

5092

RADIOACTIVE TRACER METHODS IN WOOD RESEARCH AND TECHNOLOGY. Wilhelm Sandermann. Holz Roh- u. Werkstoff 10, 81-7(1952) Mar. (In German)

Application of tracers to wood research, age determination of wood, physiological studies, and paper technology is reviewed. 30 references.

5093
THICKNESS MEASUREMENT WITH BETA RADIATION. I. GENERAL SURVEY. Torbjörn Westermark. Svensk Papperstidn. 55, 278-86(1952) Apr. 30. (In Swedish)

Techniques of thickness measurement by transmission or backscattering of β rays, selection of radioisotope, calculation of absorption coefficients, and instrumentation are discussed.

WASTE DISPOSAL

5094
Brookhaven National Lab.
ENGINEERING STUDIES OF FILTER BED EFFICIENCY FOR THE TREATMENT OF RADIOACTIVE WASTES, by Lee Gemmell. [nd] 9p. (BNL-1187)

The general layout of the BNL sewage disposal plant is shown. The efficiency of the filter beds in removing some of the most common radioactive isotopes from the laboratory low-level sewage is discussed. The amount of activity coming through the filter beds was calculated, and the radioactive waste distribution was found. About 90% of the total activity adsorbed in the filter beds remains in the top 3 in., 8% in the next 9 in., and 2% in the remaining 5 ft. A number of columns were set up to examine the possibility of the filter beds, or parts of them, becoming saturated and refusing to further hold up certain isotopes at all. For the first 16 dosings (4 days), the column removed about 98% of the activity. For the next 10 dosings (2½ days), the efficiency dropped to about 70% removal. On the 37th dosing, at the end of 9 days, only 20% of the activity was removed. Tests with specific isotopes indicated that the beds would not become saturated so that the efficiency of activity removal would drop below 50%. Over 1000 years would be required for saturation.

MINERALOGY, METALLURGY, AND CERAMICS

5095
Oak Ridge National Lab.
BIBLIOGRAPHY OF HAFNIUM OXIDE, HAFNIUM SILICATE AND HAFNIUM CARBIDE, by C. E. Curtis. Issued July 17, 1952. 22p. (ORNL-1321)

Bibliographies compiled include the properties and uses of HfO_2, history of Hf, physical properties of hafnium silicate, and preparation, properties and uses of HfC. 68 references.

CERAMICS AND REFRACTORIES

5096
Lewis Flight Propulsion Lab., NACA
INVESTIGATION OF EFFECTIVE THERMAL CONDUCTIVITIES OF POWDERS, by R. G. Deissler and C. S. Eian. June 24, 1952. 44p. (NACA-RM-E52C05)

A simplified analysis was made to determine the effective thermal conductivity of a powder from the fraction of space occupied by the gas and the conductivities of the solid and the gas which make up the powder. In order to check the analysis and to obtain data of current technical interest, tests were conducted to determine the conductivity of magnesium oxide powder in various gases at temperatures between 200° and 800°F. Good agreement was obtained between analytical and experimental results. The effects of some of the factors neglected in the simplified analysis such as the bending of heat-flow lines and the irregularity of the arrangement of the particles were investigated and discussed. (auth)

5097
Massachusetts Inst. of Tech.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES; PROGRESS REPORT, by F. H. Norton, W. D. Kingery, et al. July 1, 1952. 4p. (NYO-3140)

Additional samples of Ti carbide, Ti nitride and Zr nitride have been prepared. Difficulties have been encountered with Mo carbide. Samples of $Zr-ZrO_2$ have been prepared to determine the phases present. The surface tension and wettability equipment has been reconditioned and is now in operation. Experimental data have been obtained for the sintering of Al_2O_3 spheres at various temperatures. These data are as yet incomplete. (auth)

5098
Massachusetts Inst. of Tech.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS; PROGRESS REPORT, by F. H. Norton, W. D. Kingery, et al. July 1, 1952. 3p. (NYO-3640)

A study of the effect of porosity on the thermal conductivity of refractory materials is in progress. Experimental data have been obtained for samples having cylindrical pores of 1.43-mm diameter. These values are in quite good agreement with calculated conductivity values. Additional samples for porosity measurements having cylindrical pores 0.75 mm in diameter have been prepared. Preliminary measurements have been made to determine the feasibility of constructing an elevated temperature comparative method which seems satisfactory. Thermal conductivity specimens (prolate spheroids) have been prepared from Ti carbide and are in the process of being measured. Samples of Ti nitride and Zr nitride are being prepared. (auth)

5099
CONCERNING THE EXTRAORDINARY CHARACTERISTICS OF PURE SINTERED ALUMINUM. CONSIDERATIONS ON THE MODULUS OF ELASTICITY AND THE ELASTIC LIMIT OF THE ALUMINA-ALUMINUM COMPLEX. R. de Fleury. Rev. aluminium 29, 183-5(1952) May. (In French)

The variation of modulus of elasticity with percentage of Al_2O_3 in sintered Al, and variations of texture, surface, elastic limits, and thermal properties of this metal-ceramic substance have been studied.

CORROSION

5100
THE BEHAVIOR OF LIGHT ALLOYS IN MARINE CORROSION. III. André Guilhaudis. Rev. aluminium 29, 175-9 (1952) May. (In French)

Corrosion behavior of Al-Zn-Mg, Al-Zn-Mg-Cu, Al-Mg, Al-Si, and Al-Cu-Mg alloys immersed in sea water or exposed to spray is reported. Plating with Al or Al-Zn provided good protection for the first two alloys. Resistance to marine corrosion of Cu, Ni, Sn, Zn, ordinary steel used for ships' hulls, stainless steel (18/8), and brass also was studied.

5101
PITTING OF ALUMINUM IN A HEAVY-WATER REACTOR. Nucleonics 10, No. 7, 19(1952) July.

The extent of corrosion of fuel rods in the heavy-water reactor at Kjeller, Norway, and the conditions under which it took place are discussed briefly. Four photographs are shown.

5102
CATHODIC CORROSION OF IRON AND ANODIC FORMATION OF CRYSTALLINE FERRITE BY ELECTROLYSIS

OF FUSED SODIUM HYDROXIDE. M. Dodero. J. chim. phys. 49, C210-13(1952) Feb. (In French)

Electrolysis with Fe electrodes of fused NaOH between 500 and 750°C under certain conditions of current density and electrode separation resulted in cathodic corrosion and formation of crystalline $Na_2Fe_2O_4$ on the anode. The cathodic corrosion is explained by the hypothesis of formation of an anion, FeO_2H^-, and by electron transfer to the cathode. Secondary reactions of OH^- and FeO_2H^- at the anode result in the ferrite deposition. No corrosion occurs with a-c current.

5103

CHROMIUM IMPOVERISHMENT OF GRAIN BOUNDARIES AS CAUSE OF INTERCRYSTALLINE CORROSION OF STAINLESS STEEL. I. A. Levin. Doklady Akad. Nauk S.S.S.R. 83, 701-4(1952) Apr. 11. (In Russian)

Corrosion tests on Armco iron and low-carbon Fe-Cr alloys were carried out in HNO_3 and H_3PO_4 solutions. The results indicate that Cr impoverishment is not the cause of intercrystalline corrosion.

METALS AND METALLURGY

5104

National Bureau of Standards

FINAL REPORT TO THE UNITED STATES ATOMIC ENERGY COMMISSION ON THE URANIUM-BERYLLIUM BINARY SYSTEM, by R. W. Buzzard, James T. Sterling, Ellen A. Buzzard, and John H. Darr. [nd] Decl. July 8, 1952. 19p. (AECD-3417; NBS-D-113)

Report is made of metallographic, x-ray, and thermal-arrest investigations of Be-U alloys prepared with normal U and extruded Be. A constitution diagram is shown. One compound, UBe_{13}, occurs in the system. UBe_{13} is a stable phase having a face-centered-cubic structure and a melting point of 2000°C. A eutectic occurs at 1090°C between U and UBe_{13}, having a composition of less than 0.2 wt.% Be. The liquidus rises sharply from the eutectic to about 1800°C, reaching the maximum at the melting point of the compound. A monotectic occurs at 1555°C and 60 wt.% Be. The liquidus falls sharply at 80% Be to an almost flat liquidus between 90 and 100% Be. The solubility of Be in U is small and of U in Be undetected. The transformation temperatures of U were unaffected.

5105

National Bureau of Standards

FINAL REPORT TO THE UNITED STATES ATOMIC ENERGY COMMISSION ON THE URANIUM-TITANIUM BINARY SYSTEM, by R. W. Buzzard, R. B. Liss, and D. P. Fickle. [nd] Decl. July 8, 1952. 14p. (AECD-3418; NBS-D-112)

The uranium-titanium system within the range 0 to 30 atomic percent titanium was developed by thermal, metallographic and x-ray analysis. The liquidus rises from the melting point of uranium at 1130°C to a peritectic at 1180°C and 2.6% Ti, rising sharply to 1925°C at 30% Ti. The peritectic terminates in a sharply rising solidus at approximately 15.4% Ti. The system is characterized by two solid-solution (gamma and delta) phases which decompose eutectoidly. The gamma solid solution has a solubility of 8.8 percent titanium at 1180°C and decomposes eutectoidly at 718°C, the eutectoid composition being 5 percent titanium. The delta solid solution decomposes eutectoidly at 830°C, having a eutectoid composition of 18.3 percent titanium. The delta solid solution appears to be the high-melting phase rather than the compound (epsilon) as previously reported. The compound apparently forms peritectically and appeared in the extreme titanium end of the alloy range covered by this investigation. (auth)

5106

Institute of Engineering Research, Univ. of Calif.

CREEP OF ALLOYS RESEARCH; TECHNICAL PROGRESS REPORT TO JULY 1, 1952, by E. R. Parker and T. H. Hazlett. July 3, 1952. 4p. (COO-61)

Tensile and creep properties of a series of binary Ni alloys with Co and with Fe were investigated. From a study of the effects of Co and of Fe on the plastic properties of Ni it was concluded that the addition of Co up to ~9 at. % has no significant strengthening effect on Ni. The properties of the Fe-Ni alloys vary in a regular manner, the strength increasing with increasing Fe content. The lattice parameter of Ni, while almost unaffected by Co, was found to be increased by the addition of Fe. Progress is reported on tests of plastic properties and tensile tests at various temperatures of these alloys. Four series of solid-solution Ni alloys were prepared and data are presented on the effects of these alloy additions on creep resistance at 700°C. Preliminary data are included from a study of the effects of stress and temperature on the values of creep parameters in Ni-W alloys, from a determination of recovery characteristics of the alloys investigated, and from creep tests of Cr-Ni alloys in air and in He atmosphere to determine the influence of the oxide surface on creep resistance.

5107

Massachusetts Inst. of Tech.

SOLID SOLUTIONS AND GRAIN BOUNDARIES; TECHNICAL PROGRESS REPORT NO. 11, SCOPE II, by B. L. Averbach, M. Cohen, P. A. Flinn, E. E. Underwood, W. F. Flanagan, P. S. Rudman, and J. Hilliard. June 30, 1952. 3p. (NYO-583; Technical Progress Report No. 11)

The thermodynamic properties of the Al-Zn system were determined from emf measurements in a molten-salt electrolyte containing Al and NaCl. Sixteen alloys containing 10-95% Al were examined over a temperature range from 380° C to within a few degrees of solidus. Data obtained are discussed. Progress is reported in x-ray studies of atomic arrangements in the Al-Zn system.

5108

Metals Research Lab., Carnegie Inst. of Tech.

PROGRESS REPORT FOR JANUARY–JUNE, 1952, by R. Smoluchowski, L. Couling, S. Hayes, C. W. Haynes and R. W. Turner. July 1, 1952. 4p. (NYO-3184)

Grain-boundary diffusion of Ag in bicrystals was studied and sample preparation and Ag penetration are discussed. Correlation of autoradiographic technique with an etching technique indicated that the method needs further refinement to compare with visual observations of diffusion in crystals. Preliminary data from a study of small-angle x-ray scattering in Al-Ag samples are presented.

5109

Metals Research Lab., Carnegie Inst. of Tech.

ANNUAL REPORT FOR THE PERIOD JULY 1, 1951–JUNE 30, 1952, by R. Smoluchowski, R. Flanagan, C. W. Haynes, L. Couling, S. Hayes and R. W. Turner. July 8, 1952. 6p. (NYO-3185)

Brief note is made that a study of grain-boundary diffusion of Zn in Cu has been completed. A theory of grain-boundary diffusion is summarized. A study of recrystallization of Fe-Co alloys without and with a magnetic field has been completed. Very little experimental data are included.

5110

WELDING OF LIGHT METALS IN THE ARGON ARC. PREPARATION OF PARTS FOR WELDING BY THE NERTAL PROCESS. Charles Guinard. Rev. aluminium 29, 207-13(1952) May. (In French)

Practical data on the preparation and assembly of parts for welding of Al-Mg alloys by the argon-arc process are

presented. Surface state, selection of welding rod, edge preparation, and welding techniques are considered.

5111
THE HABIT PLANE OF THE ZIRCONIUM TRANSFORMATION. A. J. J. van Ginneken and W. G. Burgers. Acta Cryst. 5, 548-9(1952) July.

Cubic single crystals of Zr prepared by hot-wire decomposition of ZrI_4 above the transformation point, 862°C, were studied, after transformation, by etching and plotting in stereographic projection the zones normal to traces of habit planes. The habit plane was either {569} or {145}.

5112
OBSERVATIONS ON THE PREPARATION OF IODIDE TITANIUM. O. J. C. Runnalls and L. M. Pidgeon. J. Metals (N.Y.) 4, 843-7(1952) Aug.

Some observations on the kinetics of the iodide process are reported. The deposition rate is geometry-sensitive in a system containing a finely divided titanium charge. Further, results indicate that the iodine diffusion rate influences the velocity of the process. The nonvolatile iodide, TiI_3, forms in the hot filament zone, thus removing iodine from the cycle. (auth)

5113
TITANIUM-CHROMIUM PHASE DIAGRAM. F. B. Cuff, N. J. Grant, and C. F. Floe. J. Metals (N.Y.) 4, 848-53(1952) Aug.

An investigation of the Ti-Cr system has shown the presence of a complete series of solid solutions in the β phase, with a minimum in the solidus near 50% Cr. An intermetallic compound, $TiCr_2$, forms during cooling from the β solid solution. There is a eutectoid reaction at the low-chromium side of the system. (auth)

PHYSICS

5114
Atomic Energy Research Establishment, Harwell, Berks (England)
THIN FILMS; A SYMPOSIUM SPONSORED BY THE CHEMISTRY DIVISION, A.E.R.E., HARWELL AND HELD AT BUCKLAND HOUSE, 14-15TH MARCH 1951. F. Hudswell and C. J. Mandleberg, eds. Feb. 15, 1952. 51p. (AERE-C/R-861)

This report consists of a collection of papers presented at the Symposium on Thin Films. The purpose of the Symposium was not so much to concentrate attention on the purely scientific aspects of thin films as to bring together the users and the producers of different types of thin films and to have the various methods of preparation and types of film discussed. Nevertheless, some attention has been given to the physical and chemical structure of thin films especially in relation to mode of preparation and also in relation to uniformity, adhesion, and strength. The titles of the papers which are included are as follows: "The Uses and Characteristics of Thin Films," "The Adhesion and Stability of Films," "Methods Available for the Preparation of Thin Films," "Vacuum Coating by Sputtering and Thermal Evaporation," "The Sublimation Technique for the Preparation of Thin Films of Plutonium," "The Painting Technique for the Preparation of Films," "The Electromagnetic Separator as a Means of Preparing Thin Films," "The Preparation of Films for Electron Analysis," "Electrodeposited Films," "Aluminum Oxide Films," and "The Preparation of Films for α-Counting."

5115
Atomic Energy Research Establishment, Harwell, Berks (England)
THE EQUILIBRIUM CONSTANT FOR THE DYSPROSIUM–T.T.A.–BENZENE SYSTEM, by F. W. Cornish. Mar 31, 1952. 4p. (AERE-C/R-891)

A value of 3.6×10^{-8} has been obtained for the equilibrium constant of the Dy-T.T.A.-Benzene system. The method and results are discussed.

5116
Atomic Energy Research Establishment, Harwell, Berks (England)
MAGNETOCHEMICAL EVIDENCE CONCERNING THE ELECTRONIC STRUCTURE OF THE HEAVIEST ELEMENTS, by J. K. Dawson. Mar. 18, 1952. 17p. (AERE C/R-908)

In a review of the electronic configurations of the heavy elements the magnetic properties of heavy-element ions of 1 through 7 unpaired electrons are described. A brief description of classical paramagnetic theory is presented.

5117
Columbia Univ.
QUARTERLY PROGRESS REPORT [ON] THERMODYNAMIC PROPERTIES OF SODIUM VAPOR, by W. A. Selke, C. H. Muendel, and H. Y. Krinsky. Mar. 1, 1952. 2p. (NYO-3098)

An apparatus for measuring the vapor pressure of radium in the range 500° to 1200°C has been designed and is now being completed. The method to be used consists essentially of boiling radium under argon at a known pressure and measuring the temperature at a point of vapor-liquid equilibrium. The data will be used to extend the experimentally known areas of the T-S and H-S diagrams for radium. Since the dimer content of radium increases with temperature along the boiling point curve, the data will also be used to determine the validity of the standard vapor pressure equations for this case with a possible view toward extrapolation into higher temperature regions. The apparatus is described in detail in a previous report, NYO-3097 (NSA 6-1670). (Entire report)

5118
HEAT CONDUCTION BY THE UNSATURATED HELIUM II FILM. Earl Long and Lothar Meyer. Phys. Rev. 87, 153 (1952) July 1.

Report is made of preliminary measurements of the transport of heat by saturated and unsaturated He II films. For an unsaturated film of given thickness the contribution to the heat transport is zero at all temperatures above a sharply defined temperature T_f. At this temperature the film contribution appears abruptly, rising to relatively large values at lower temperatures, depending on the film thickness and the temperature. The temperature T_f is identical with "onset" temperature for film flow. At all temperatures below T_f, film flow occurs and contributes to the heat transport.

5119
PHASE TRANSITIONS IN ADSORBED FILMS. Lothar Meyer and Earl Long. Phys. Rev. 85, 1035-7(1952) Mar. 15.

A thermodynamic treatment of first- and second-order transitions in adsorbed layers is given. The results are compared with the experimental evidence for the melting of argon and the transition He I–He II in adsorbed layers. (auth)

5120
SOME EXPERIMENTS ON FLOW IN THE UNSATURATED HELIUM II FILM. Earl Long and Lothar Meyer. Phys. Rev. 85, 1030-5(1952) Mar. 15.

The mass flow in adsorbed layers of helium has been measured. Superfluidity occurs at all temperatures below the λ temperature of the bulk liquid down to 1½ statistical layers. The bearings of these results on the thermodynamics of transition He I–He II in adsorbed layers is discussed. (auth)

5121

A MECHANISM FOR SPUTTERING IN THE HIGH VACUUM BASED UPON THE THEORY OF NEUTRON COOLING. Frank Keywell. Phys. Rev. 87, 160-1(1952) July 1.

A Phillips Ion Gauge Discharge has been used as a source of ions to measure absolute sputtering ratios (number of atoms sputtered per incident ion) for silver metal bombarded by argon ions. The results of a series of measurements at various ion energies are plotted. A point of interest in the data is the small number of atoms sputtered per incident ion compared to the number which is energetically possible. Neglecting heat conduction, a 4000-volt ion incident on silver has sufficient energy to sputter 975 atoms, yet the actual number sputtered is 8. In agreement with the observed inefficiency of ions in releasing secondary sputtered particles, the following theory of sputtering in high vacuum is proposed: An energetic ion, upon striking the crystalline lattice, will be "cooled" by a diffusion-collision mechanism similar to neutron cooling. In the process it will make a small number of collisions with the atoms of the material being sputtered, these collisions being violent enough to cause the metal atoms to be dislodged from the lattice and removed as sputtered material. After the incident ion has made sufficient collisions to cool it to some characteristic energy the sputtering process will stop.

5122

THE SPECIFIC HEAT OF LIQUID HELIUM BETWEEN 0.25 AND 1.9°K. H. C. Kramers, J. D. Wasscher, and C. J. Gorter. Physica 18, 329-38(1952) May. (In English)

New measurements were made of the specific heat of liquid He employing a capillary-connected calorimeter and using the demagnetization method with a properly chosen paramagnetic salt for reaching temperatures below 1°K. It was found that the specific heat below 0.6°K satisfies a T^3 law as was expected from theoretical predictions. Above this temperature, the measured values were compared with Landau's formula on the roton specific heat. These new values of the specific heat were used for the recalculation of the entropy of liquid He II. (auth)

5123

RECENT ADVANCES IN OUR KNOWLEDGE OF THE NUMERICAL VALUES OF THE FUNDAMENTAL ATOMIC CONSTANTS. Jesse W. M. DuMond and E. Richard Cohen. Am. Scientist 40, 446-67(1952) July.

Recent developments in microwave and atomic beam techniques, as well as in other fields such as electrochemistry and atomic mass determinations, seem likely to revolutionize the precision and interconsistency with which constants such as N, Avogadro's number; e, the electronic charge; m, the electronic mass; or h, Planck's constant, are now known. Some of the newer and more interesting sources of this knowledge are here simply described. A table of the latest values (December 1950) of the atomic constants and conversion factors derivable therefrom is appended. (auth)

5124

ON THE FLOW OF He II AROUND A SPHERICAL OBSTACLE. H. H. Woldringh. Physica 18, 277-84(1952) May. (In English)

The flow of He II around a thermally conducting spherical obstacle is investigated theoretically on the basis of the two-fluid model, the boundary conditions at infinity being that the velocities of the normal and superfluid components may have different magnitudes, but shall lie in the same direction, while the temperature there also has a given value. The temperature, pressure, and velocity fields, as well as the force exerted by the fluid on the sphere, are derived on the assumption that terms quadratic in the velocities may be neglected. (auth)

ASTROPHYSICS

5125

THE POLYNEUTRON THEORY OF THE ORIGIN OF THE ELEMENTS. R. E. Peierls, K. S. Singwi, and D. Wroe. Phys. Rev. 87, 46-50(1952) July 1.

Assuming as an early stage in the expansion of the universe a homogeneous fluid of nuclear density and low temperature, it is shown that, for reasonable values of the constants, this will, on expansion, leave the matter in the form of droplets of the same properties as those found in the Mayer-Teller "polyneutron" theory. However, this model leads necessarily to an abundance curve in which the amount of heavy elements is at least comparable to that of the light elements, contrary to experience. (auth)

COSMIC RADIATION

5126

DETECTION OF PARTICLE SHOWERS BY SCINTILLATION COUNTERS. R. Ascoli. Nuovo cimento (9) 9, 610-14(1952) July. (In Italian)

It is shown that scintillation counters are particularly apt to reveal showers even when these are constituted of few fast particles; so they can be substituted for coincidence devices. Such a possibility is demonstrated by experiments on cosmic rays. On setting a Pb absorber (15 g/cm²) on a scintillation counter, a great increase in the rate of the higher pulses was observed. This is attributed to electron and photon showers produced in the Pb by the soft component. With a water absorber (15 g/cm²) the increase was much less. (auth)

5127

THE NUCLEONIC COMPONENT IN THE ATMOSPHERE. II. E. Clementel and F. Ferrari. Nuovo cimento (9) 9, 572-9(1952) July. (In Italian)

The spectra of proton and neutron components between 400 and 2200 Mev are given for the three atmospheric depths 1033, 680, and 310 g/cm². The contributions due to radiative and nonradiative collision processes are discussed separately. Winckler's primary proton spectrum (NSA 4-5925) has been used. Both the ionization energy loss and the loss suffered in passing through a nucleus are assumed constant. The results obtained are in good agreement with the existing experimental observations on the behavior of the proton component in air and on the latitude effect. For the proton-neutron ratio, distinction has been made between a function giving the ratio of secondaries only of both the components, and the real ratio, which takes account of the residual primary proton spectrum. The former, not higher than unity, is a very slowly varying function of the depth, the latter coincides practically with the previous one in the low and middle atmosphere and increases rapidly approaching the top of the atmosphere. (auth)

5128

ENERGY SPECTRUM OF ELECTRONS IN EXTENSIVE COSMIC-RAY SHOWERS. C. Milone. Nuovo cimento (9) 9, 549-71(1952) July. (In Italian)

The energy spectrum of extensive cosmic-ray showers has been studied at sea level by means of G-M counters, at two distances, d = 0 and d = 50 m, from the core of the showers. Showers were successively selected having, near the core, average density Δ = 72, 42, 25, 12.5, 6.25, and 3.14 particles/m². The results show that the energy spectrum of

the electrons in the showers can be expressed by the relation $N = K(E + E_c)^{-\epsilon}$, where N is the number of the electrons with energy greater than E, E_c is the critical energy in air, and ϵ is an exponent which depends on Δ and on the distance of the electrons from the core. The experimental values of ϵ are lower than the ones predicted by the cascade theory; furthermore, at d = 50 m electrons have been found with energies too high to be explained on the basis of an electronic cascade initiated in the high atmosphere by a single electron. The disagreement can be eliminated if it is supposed that in the extensive showers electrons are also produced by a component, say the N component, which is absorbed in air less than the electrons and contributes to the shower development throughout the atmosphere. (auth)

5129
ON THE INTERACTION OF COSMIC RAYS WITH MATTER UNDER 50 METERS WATER EQUIVALENT. E. Amaldi, C. Castagnoli, A. Gigli, and S. Sciuti. Nuovo cimento (9) 9, 453-5(1952) May. (In English)

Hodoscopic studies were made underground, at a depth of 50 m water equivalent from the top of the atmosphere, on the production of single secondary particles by the interaction of a penetrating particle (μ meson?) with a Pb nucleus. The following cross sections were found for this process:

Penetration of secondary g/cm^2	σ cm^2/nucleon
57	$6 \pm 1 \times 10^{-30}$
113	$5 \pm 1 \times 10^{-30}$
170	$2 \pm 1 \times 10^{-30}$

The values agree in order of magnitude with the results of George and Evans (NSA 5-634) and Cocconi Tongiorgi (NSA 5-7144).

5130
THE HARD COMPONENT OF COSMIC RAYS IN THE UPPER ATMOSPHERE.. Malcolm A. Clark. Phys. Rev. 87, 87-90(1952) July 1.

An experiment has been performed in the upper atmosphere to study charged cosmic-ray particles that penetrate 20 cm of lead. These particles were divided into two groups depending on whether or not they interacted on traversing the lead. The experimental equipment, which consisted of the lead absorber, G-M tubes in coincidence, and radio telemetering devices, was carried to high altitudes by an array of 36 balloons. The rate of occurrence of particles in the two groups was determined as a function of atmospheric depth from 16 g-cm^{-2} to 400 g-cm^{-2}. The experimental results can be interpreted in terms of high-energy protons and μ mesons, with corrections for low-energy protons and primary alpha particles. The results are consistent with a primary-proton intensity equal to 0.19 cm^{-2} sec^{-1} sterad^{-1}, an absorption length in air of 110 g-cm^{-2} for high-energy protons, and the μ-meson production spectrum given by Sands. (auth)

5131
A STUDY OF PENETRATING COSMIC-RAY SHOWERS IN WATER. George W. Rollosson. Phys. Rev. 87, 71-4(1952) July 1.

Penetrating showers produced locally by non-ionizing radiation were studied using counter techniques. The collision length in water of the non-ionizing component which is capable of producing penetrating showers was found to be (98 ± 13) g/cm^2. Comparison of this collision length with that expected from the geometrical cross section seems to indicate that the hydrogen nuclei in water have a rather small cross section for the production of penetrating showers by neutral radiation. Results obtained at two elevations were used to calculate the absorption length in air of the neutral penetrating-shower-producing component. The absorption length measured, 115 ± 19 g/cm^2, agrees with that obtained by others for the total penetrating-shower-producing component. (auth)

5132
THE ABUNDANCE OF LITHIUM, BERYLLIUM AND BORON IN THE PRIMARY COSMIC RADIATION. A. D. Dainton, P. H. Fowler, and D. W. Kent. Phil. Mag. (7) 43, 729-52(1952) July.

In a previous paper (see NSA 5-4210) a method of determining the charge of heavy nuclei in the cosmic radiation was described which depended on measuring the δ-ray density along a track in a photographic emulsion and the multiple scattering of the particle. The results suggested the presence of a large proportion of the light elements lithium, beryllium, and boron in the radiation, a result in contradiction with that of other workers. The first part of the present paper describes a re-examination of the original method and evidence for its reliability. It is shown that an alternative method, based on observations of grain density in the tracks of heavy particles recorded in less sensitive emulsions, gives results in agreement with those obtained by the δ-ray method. In the second part, the results of a more extended series of measurements by the δ-ray method are described. The results indicate that at geomagnetic latitude 55° N the flux of lithium, beryllium and boron nuclei in the cosmic radiation is equal to, or larger than that of carbon, nitrogen and oxygen. Finally, the bearing of the results on the origin of the cosmic radiation is briefly discussed. (auth)

ELECTRONS

5133
AN APPROXIMATION METHOD FOR THE SINUOUS TRAJECTORIES OF HIGHLY CONVERGENT LENSES. F. Bertein. J. phys. radium 13, 309(1952) May. (In French)

The approximation method given previously by the author (NSA 6-4110) is applicable only with difficulty to highly convergent electron lenses, since trajectories in such lenses have a sinuous form not easily represented by simple polynomials. A method of representing the principal trajectory in an electrostatic lens of revolution having a symmetric axial potential is derived which is also satisfactory for highly convergent electrostatic mirrors.

INSTRUMENTS

5134
Atomic Energy Research Establishment, Harwell, Berks (England)

A PNEUMATIC CONVEYOR FOR BEPO IRRADIATION CANS, by G. Shepherd and R. West. Mar. 24, 1952. 11p. (AERE I/R-880)

A description is given of the construction and performance of a remotely controlled apparatus, developed by the Isotope Division at Harwell, for the transfer of radioactive sources from place to place through a pneumatic tube.

5135
Ames Lab.

A CONTINUOUSLY VARIABLE 0.5-100 AMPERE CONTROL SYSTEM FOR RESEARCH APPLICATIONS, by Alvin A. Read. Mar., 1952. 54p. (ISC-221)

Design is reported of a continuously variable 0.5 to 100 ampere d-c control system for research use and specifically for a magnetic-lens β-ray spectrometer. Primary system components, construction and performance of a generator loop, and construction and performance of the current regulator are discussed.

5136
Tennessee Univ.
A HIGH TEMPERATURE CALORIMETER FOR SOLID STATE MEASUREMENTS; A REPORT OF ACTIVITIES [FOR] SEPTEMBER 1951–JUNE 1952, by E. E. Stansbury. June 1, 1952. 66p. (ORO-74)

The design and development of a high-temperature, continuously measuring calorimeter for experimental thermodynamic measurements of solid state phenomena is described. The primary interest is the measurement of stored energy in metals and alloys due to plastic deformation. Methods of sample preparation, components of the calorimetric system, desirable operating conditions, and difficulties encountered in the application of thermocouple materials in the investigation are discussed in detail. The apparent specific heat data obtained are reported and discussed.

5137
APPARATUS FOR THE STABILIZATION OF PHOTOMULTIPLIERS. R. Ascoli. Nuovo cimento (9) 9, 615-17(1952) July. (In Italian)

A special automatic stabilizer for scintillation counters is described. The constancy of emission of a radioactive source is used to eliminate the troubles deriving from the unsteadiness of photomultipliers with time. The device has given good results in experiments on cosmic rays. (auth)

5138
A PRECISION DIFFERENTIAL MANOMETER. G. J. Maslach. Rev. Sci. Instruments 23, 367-9(1952) July.

The requirements imposed by investigations of flow and heat transfer characteristics of low density gases have been met by developing a precision manometer for measuring pressures in the range from approximately 0.05 to 20 mm Hg. The instrument makes use of optical elements to allow the observer to view a clear magnified image of the meniscus. Precision lead screws and gearing control the movement of the optical viewing systems and together with a mechanical differential indicate the differential height on a counter directly in thousandths of an inch. The instrument employing a low-vapor-pressure oil can be operated and read rapidly, and the reproducibility of its readings by different observers is half its least count, or 0.001 mm Hg. (auth)

5139
A GENERATOR OF 0.2 TO 10 μSEC SQUARE PULSES. R. Querzoli. Rend. ist. super. sanità 15, 162-7(1952). (In Italian)

A circuit for the production of rectangular pulses of 0.2- to 10-μsec duration and 300-v amplitude is described. Use in nuclear physics or cosmic-ray studies is suggested.

5140
PULSE-AMPLITUDE ANALYSIS IN NUCLEAR RESEARCH. PART I. VOLTAGE DISCRIMINATORS. A. B. Van Rennes. Nucleonics 10, No. 7, 20-7(1952) July.

Two general methods of obtaining a pulse-amplitude distribution spectrum are reviewed. Voltage discriminators involving a biased diode or a biased amplifier are discussed in more detail. The Schmitt circuit with several variations and a high-speed discriminator circuit with a fixed dead-time of 0.2 μsec are described and diagrams are shown. 16 references.

5141
A UNIFORM SOLENOIDAL MAGNETIC FIELD NUCLEAR SPECTROMETER. F. H. Schmidt. Rev. Sci. Instruments 23, 361-6(1952) July.

The mechanical and electrical features of a ring-image-type spectrometer are described. The baffle system may be rolled out of the vacuum chamber for ease of adjustment. The predicted momentum resolution vs. percent transmission has been verified; e.g., 0.4 percent resolution at 2 percent transmission. A close doublet in the internal conversion spectrum following beta-decay of Cs^{134} has been observed. The lines differ in momentum by 0.6 percent. (auth)

ISOTOPES

5142
TECHNIQUE FOR COLLECTING AND PURIFYING NATURAL AND VOLCANIC GASES. M. Santangelo. Ann. geofis. (Rome) 5, 27-32(1952) Jan. (In Italian)

The results of mass-spectrometric analysis of the A isotopic composition in natural gases have been reported in previous papers. The devices therein employed for picking up natural gases are reported. Methods for collecting volcanic and fumarolic gases are described, and the method used in preparing the A samples is summarized.

5143
PILE-PRODUCED RADIOACTIVE MATERIALS AND THEIR USES. W. J. Arrol. Endeavour 11, 61-71(1952) Apr.

The preparation and distribution of radioactive materials by the isotopes division at Harwell and the radiochemical center at Amersham, England, are discussed.

ISOTOPE SEPARATION

5144
SEPARATION OF BINARY MIXTURES. Alfred Klemm. Z. Naturforsch. 7a, 417-21(1952) June. (In German)

The nonlinear differential equations for separation of a binary mixture in an infinitely long thermal-diffusion column (trennrohr), closed at one end, have been solved with the help of a transformation given by Majumdar (Phys. Rev. 81, 844(1951); NSA 5-2210). The time dependence of the separation factor at the end of the diffusion column is presented graphically for various mixture ratios, and compared, for the extreme ratios 0 and ∞, with that of a diffusion column of finite length.

MASS SPECTROGRAPHY

5145
MASS-SPECTROMETRIC INVESTIGATION OF SH_2, SeH_2, PH_3, SiH_4, and GeH_4. H. Neuert and H. Clasen. Z. Naturforsch. 7a, 410-16(1952) June. (In German)

The relative ionization and dissociation frequencies and critical potentials for electron collision of the gases H_2S, H_2Se, PH_3, SiH_4, and GeH_4 in a mass spectrometer were measured. The dissociation probabilities increased with molecular mass for all isotopically possible ionic types, as expected from chemical behavior. Correspondingly, the critical potentials dropped steadily with molecular mass for each ionic type.

MATHEMATICS

5146
Nuclear Physics Lab., Case Inst. of Tech.
EQUIVALENCE THEOREMS FOR PSEUDOSCALAR COUPLING; TECHNICAL REPORT NO. 17, by J. M. Berger, L. L. Foldy and R. K. Osborn. [nd] 15p. (AECU-2127; Technical Report No. 17)

By a unitary transformation a rigorous equivalence theorem is established for the pseudoscalar coupling of pseudoscalar mesons (neutral and charged) to a second-quantized nucleon field. By the transformation the linear pseudoscalar coupling is eliminated in favor of a nonlinear pseudovector coupling term together with other terms. Among these is a term corresponding to a variation of the effective rest mass of the nucleons with position through its dependence on the meson potentials. The question of the connection of the nonlinear pseudovector coupling with heuristic proposals that such a coupling may account for the saturation of nuclear

forces and the independence of single nucleon motions in nuclei is briefly discussed. The new representation of the hamiltonian may have particular value in constructing a strong coupling theory of pseudoscalar coupled meson fields. Some theorems on a class of unitary transformations of which the present transformation is an example are stated and proved in an appendix. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

5147

National Bureau of Standards

PENETRATION AND DIFFUSION OF X-RAYS: CALCULATION OF SPATIAL DISTRIBUTIONS BY SEMI-ASYMPTOTIC METHODS, by L. V. Spencer. June 18, 1952. 44p. (NBS-1726)

Methods are presented for calculating x-ray spectra in an infinite homogeneous medium. These methods are particularly useful for calculating spectra at great distances from the radiation source. The transport equation is solved numerically by characterizing angular and spatial distributions with a small number of suitable parameters. Attention is called to a mathematical technique which is extremely useful for this purpose, whereby a function may be approximated from a knowledge of moments, derivatives, or values. Sample numerical applications include spectral intensities at various distances from a plane monodirectional 10.22-Mev x-ray source in Pb and a plane monodirectional 5.11-Mev source in Fe. (auth)

5148

DEDUCTION OF THE CONCENTRATION OF URANIUM AND THORIUM IN RADIOACTIVE SUBSTANCES WITH THE PHOTOGRAPHIC METHOD. G. Imbò and L. Casertano. Ann. geofis. (Rome) 5, 1-12(1952) Jan. (In Italian)

Equations for the statistical distribution of α particles in nuclear emulsion as a function of the projection of particle track on the plate are derived for thicknesses of material from zero to the limit represented by the range of α particles in the substance being examined. From these equations distribution curves have been calculated and graphed for the U-Ac and Th groups. Distribution curves also are given for U to Th concentration ratios, and methods for calculating the individual concentrations of U and Th are described.

5149

PHOTOMETRIC MEASUREMENTS OF TRACKS IN NUCLEAR EMULSIONS. M. Della Corte and M. Ramat. Nuovo cimento (9) 9, 605-9(1952) July. (In English)

The blackening of low-energy tracks in nuclear emulsions is determined by a photometric method. Results are discussed, and it is shown how a value for the resolved track area may be obtained. Finally it is shown that by an appropriate analysis of photometric profiles, corresponding to slits of increasing width, the error introduced by the light scattered in the emulsion may be eliminated. (auth)

5150

A CONTINUOUSLY OPERATED CLOUD CHAMBER. Edgar M. Munyon and J. D. Kurbatov. Rev. Sci. Instruments 23, 380-1(1952) July.

A modification of the diffusion-type continuously operated cloud chamber was developed to obtain alpha-spectra of short-lived radioactive species. It maintains a constant calibration and permits observing and photographing tracks within a few minutes after insertion of the sample. The chamber operates by the diffusion of vapor from the warm surface at the top of the cold surface at the bottom. At a particular level in the chamber, a supersaturated condition forms a track-sensitive layer where condensation occurs on ions.

5151

A DEVICE FOR FILLING NEUTRON COUNTERS WITH BORON TRIFLUORIDE. G. Cortellessa. Rend. ist. super. sanità 15, 168-80(1952). (In Italian)

Purification of BF_3 by vacuum distillation and the technique of filling ionization chambers and neutron counters with this compound are described.

5152

SOLID AND LIQUID SCINTILLATION COUNTERS. George T. Reynolds. Nucleonics 10, No. 7, 46-53(1952) July.

Included in this review are both reference data and new material collected at Princeton University on the following aspects of the subject: characteristics of scintillation counters and their relation to other types of counters in particle detection; common scintillation materials, their properties and preparation (solid and liquid; organic and inorganic); detailed consideration of speed and energy response; consideration of the scintillation process, including quantum efficiencies, quenching, transport, etc. 37 references.

5153

QUESTION OF X-RAY DOSIMETRY WITH SOLIDS. I. Broser, H. Oeser, and R. Warminsky. Z. Naturforsch. 7a, 351-60(1952) May. (In German)

A series of crystalline solids (CdS, ZnS(Cu), ZnO, $CaWO_4$, KBr(Tl), white sapphire (Al_2O_3), diamond, and various organic compounds) were investigated for suitability as x-ray dosimeters. Luminescence and conductivity are in general proportional to absorbed radiation. Wave-length dependence of the absorption is strongly dependent on the effective concentration. Correspondence to the behavior of air ionization chambers is discussed. Certain organic scintillators have effective concentrations close to that of air. The absorption of some solids is so high that all radiation is absorbed, making these crystals suitable for total-intensity measurements.

5154

BREAKDOWN POTENTIAL OF COUNTER TUBES. Karl Heinz Lauterjung. Z. Naturforsch. 7a, 344-51(1952) May. (In German)

An equation showing the functional interdependence of breakdown potential, tube radius, wire radius, total pressure of filling gas, and, for self-quenching counters, per cent vapor content is derived for the working region of G-M tubes. Calculations for various commonly used gases and vapors are presented, and nomographs are constructed.

5155

INDUCED CONDUCTIVITY AND LIGHT EMISSION IN DIFFERENT LUMINESCENT TYPE POWDERS. Hartmut Kallmann and Bernard Kramer. Phys. Rev. 87, 91-107(1952) July 1.

The currents induced in various (Zn:Cd)S luminescent-type powders by ultraviolet radiation have been investigated as well as the quenching and stimulating effects due to infrared radiation. Similar experiments on the fluorescent emission have also been carried out. Currents induced in these powders by high-energy-particle radiation is also described. A model is proposed which contains two types of electron traps, deep traps and shallower traps (which are associated with the emission levels at the activator), and a coupling between the deep traps and the emission levels is assumed. Theoretical calculations based on this model are compared to the experimental results for stationary and non-stationary behavior. This comparison shows that in all (Zn:Cd)S powders investigated, traps exist from which so-called "direct transitions" to the activators occur with negligible contribution to the conductivity. These transitions may not be radiative, and they also occur in materials which

exhibit no noticeable light-stimulation by infrared radiation. (auth)

5156
DECAY TIMES, FLUORESCENT EFFICIENCIES, AND ENERGY STORAGE PROPERTIES FOR VARIOUS SUBSTANCES WITH GAMMA-RAY OR ALPHA-PARTICLE EXCITATION. Loran Bittman, Milton Furst, and Hartmut Kallmann. Phys. Rev. 87, 83-6(1952) July 1.

The results of measurements of the decay time of light flashes induced by gamma-ray quanta, or alpha particles by means of pulse-distribution curves for various crystals, powders, and solutions are presented. The decay of organic substances can be described essentially by a single exponential; in addition, a small more slowly decaying portion is present. The decay of inorganic crystals can be represented by a sum of exponentials with time constants in different ranges. The results support a previous explanation of the lower efficiency of alpha particles in producing fluorescence when compared to gamma rays. Results on various activated inorganic crystals of integrated fluorescent light output under gamma rays and peak height measurements under gamma-ray and alpha-particle bombardment are also presented. The relative integrated and peak height properties are not well correlated, neither are the responses to gamma rays and alpha particles. Such variations are associated with the different emission times of the crystals. It is found that CsBr and CsI activated with Tl are excellent crystals with respect to luminescent properties especially when volume is a factor. The capability of these crystals to store energy to be released later as light by light of longer wavelengths is also indicated. Very good storage and stimulation properties are shown only by NaCl crystals activated with AgCl. (auth)

5157
MULTICHANNEL COLLIMATORS FOR GAMMA-RAY SCANNING WITH SCINTILLATION COUNTERS. R. R. Newell, William Saunders, and Earl Miller. Nucleonics 10, No. 7, 36-40(1952) July.

To locate a tumor that has taken up radioiodine, the counter must look through a narrow collimator if the tumor is at the center of the brain. The length of the collimator, the relative advantages of a multichannel and a single-channel collimator, the optimum size of beam, statistical error involved, collimator construction, and the special problem of detecting small tumors are discussed.

5158
TEMPERATURE EFFECTS IN ORGANIC FLUORS. S. H. Liebson. Nucleonics 10, 41-5(1952) July.

The physical processes involved in the production of scintillations in organic crystals under γ excitation are reviewed. Experiments are described in which the decay time of individual scintillations and the decay time of fluorescence were measured. Results of light output vs. temperature measurements are shown graphically. In general, decay times decreased or remained constant with decrease in temperature.

5159
THE LUMINESCENCE OF ORGANIC SUBSTANCES. E. J. Bowen. Nucleonics 10, No. 7, 14-18(1952) July.

The mechanism of the luminescence process is discussed for the case of ultraviolet light, with extension to the case of nuclear radiation. Characteristics of fluorescent substances which affect their use for radioactivity measurement are pointed out. Effects of various radiations on organic molecules are compared.

5160
COUNTERS WITH INTERNAL FILLING FOR NUMERATION OF LOW-ENERGY β PARTICLES. Michel Grenon and Rodolphe Viallard. J. phys. radium 13, 310-11(1952) May. (In French)

A Maze-type internal counter for low-energy β emitters, such as C^{14}, S^{35}, and especially H^3, is described. When filled with alcohol (1 cm Hg) and A (9 cm Hg), the threshold is 1040 v and the plateau is 550 v in length. For H^3 counting, H_2 is added to the filling gas, raising the threshold; e.g., at 24 mm H_2, the threshold is 1345 v, at 35 mm, 1425 v. Some preliminary experiments on the time required for degassing, etc., during H^3 determination are mentioned.

5161
SURVEY METHODS FOR SLOW NEUTRONS. Burton J. Moyer. Nucleonics 10, No. 4, 14-17(1952) Apr.

Three methods are briefly reviewed for measuring thermal and near-thermal neutrons, involving BF_3 counters, a BF_3 ionization-current technique, and foil activation.

5162
RELATIVE TRANSMISSION OF BETA PARTICLES THROUGH G-M COUNTER WINDOWS. Chia-Hua Chang and C. Sharp Cook. Nucleonics 10, No. 4, 24-7(1952) Apr.

The method described for measuring window transmission uses the acceleration of β particles from the source of a magnetic lens spectrometer. An Al foil (7.32 mg/cm^2) is used as an illustration, and data for it are given. The limitations of the method are discussed.

5163
LATEST DEVELOPMENTS IN SCINTILLATION COUNTING. Nucleonics 10, No. 3, 32-41(1952) Mar.

Digests are presented of the papers and discussions presented at the Scintillation Counter Symposium in Washington, D. C. on Jan. 29 and 30, 1952. The symposium was divided into four sessions. In the first, the emphasis was on photomultipliers; in the second, on phosphors. The emphasis of the third and fourth sessions was placed on coincidence counting and circuitry.

5164
ELECTRONIC APPARATUS FOR IN VIVO ASSAY OF PLANTS. R. P. Martin. Nucleonics 10, No. 1, 50-3(1952) Jan.

Equipment has been designed and constructed which will record the impulses from a number of counters with the use of only one scaler for periods of several days. At any time, one counter is connected by the counter switch to its appropriate power supply and to the quench unit which in turn feeds the scaling unit. Pulses from the scaling unit operate the recorder. The switch-control unit provides for the following variations in mode of operation: length of time during which each counter is connected can be ½, 1, 2, or 4 min; the number of counters in use can be 1, 2, 3, or 4; the scale factor can be varied in multiples of 2 from 1 to 128 for each counter independently. The components which are different from standard types are described. Brief report is made of the results of a study of diurnal changes of the labeled-phosphate content of the leaves of barley seedlings.

5165
TESTS ON SCINTILLATION G-M TUBES. V. M. Daggs, W. H. Parr, and A. T. Krebs. Nucleonics 10, No. 1, 54-5 (1952) Jan.

Report is made of preliminary measurements of the response of three different scintillation G-M tubes as a Po α source was moved parallel to the tube and as the source-to-tube distance was varied. The response of each of the three tubes was found to depend greatly on the position of the radiation source in relation to the tube's geometry and construction. The influence of the size of the scintillation area was studied by using windows. With a uniform distribution of Po on the carrier metal, the counting rate obtained was found to be directly proportional to the phosphor area exposed. The smallest area studied was 0.45 mm^2. With this area, an increase in counts significant-

lv different from the background was obtained in normal counting times. These tubes should be of use in range-dependence and radiobiology studies.

5166
ABSOLUTE MEASUREMENT OF BETA ACTIVITY. C. Sánchez del Río, Oscar Jiménez Reynaldo, and E. Rodríguez Mayquez. Anales real soc. ẽspan. fís. y quím. A48, 127-32(1952) May-June. (In Spanish)

An internal G-M counter of new design for absolute β counting of solid samples is described. Backscattering correction when using an "infinitely thick" mounting is discussed.

5167
A HEAVY PARTICLE SELECTOR. T. Duerden and B. D. Hyams. Phil. Mag. (7) 43, 717-23(1952) July.

A system of Geiger counters and a Cherenkov light detector is described which responds selectively to the passage of slow cosmic particles heavier than about 550 m_e. It has been shown to count at a rate consistent with the known flux of sea-level protons, and cloud-chamber photographs show that at least 80% of the counts are caused by protons of range less than 170 g/cm^2 lead. (auth)

MESONS

5168
INTERACTION OF π MESONS WITH NUCLEAR MATTER. E. Clementel. Nuovo cimento (9) 9, 369-71(1952) Apr. (In Italian)

Expressions for the elastic scattering and reaction cross sections for π mesons on nuclei and for the deviations caused by coulomb and nuclear forces are derived. Published experimental data on interactions of π mesons with carbon nuclei are used to establish certain parameters.

5169
NUCLEAR CAPTURE OF μ MESONS. P. Budini. Nuovo cimento (9) 9, 445-8(1952) May. (In Italian)

The theory of μ^- capture by proton or neutron with emission of an electron, i.e., $\mu^- + P \rightarrow P' + e^-$, $\mu^- + N \rightarrow N' + e^-$, is discussed, and experimental evidence (electron spectra in nuclear emulsion) for this process is presented briefly.

5170
ISOBARIC STATES OF NUCLEONS AND SCATTERING OF π MESONS BY PROTONS. E. Ferretti. Nuovo cimento (9) 9, 312-13(1952) Mar. (In Italian)

Observation of decay of V particles into a proton and probably a π meson has suggested the existence of isobaric or excited states of nucleons. How these might be investigated by measuring the scattering cross sections of positive and negative π mesons on protons is discussed briefly.

5171
NONLINEAR PSEUDOSCALAR MESON THEORY. E. M. Henley. Phys. Rev. 87, 42-5(1952) July 1.

An attempt is made to explain nuclear saturation by means of a nonlinear pseudoscalar meson field. The same nonlinearity as that introduced by Schiff for the scalar case is employed; the treatment follows similar lines, using classical field theory. The total source strength is calculated for an isolated nucleon at rest, and an expression for the two-nucleon interaction in free space is obtained. It is shown that both of these are infinite, so that a cutoff must be introduced. For the two-nucleon problem the variation method is used with a simple trial function, which is the superposition of the single-nucleon meson field amplitudes; this should be a good approximation for large separation of the nucleons. Then the nonlinear terms of the two-particle interaction are shown to be separable from the linear ones, and are repulsive. The nonlinear terms can also be separated in the many-body problem, but they are not necessarily positive definite here, and hence need not lead to saturation. A nuclear model, based on a lattice structure with stationary nucleons is discussed qualitatively. (auth)

5172
AN EXAMPLE OF MULTIPLE MESON PRODUCTION. W. Bosley and H. Muirhead. Phil. Mag. (7) 43, 783-9(1952) July.

A description is given of an event, found in a nuclear emulsion exposed to the cosmic radiation in which two π mesons and a proton or deuteron are the only particles observed. Reactions which could produce this event are discussed. (auth)

5173
NUCLEAR INTERACTIONS OF GREAT ENERGY. PART I. EVIDENCE FOR THE CREATION OF HEAVY MESONS. R. R. Daniel, J. H. Davies, H. Mulvey, and D. H. Perkins. Phil. Mag. (7) 43, 753-74(1952) July.

The masses of charged mesons produced among the "shower" particles in the nuclear interactions of protons of great energy have been determined by scattering and grain-density measurements. For energies greater than 50 bev heavy mesons of mean mass ~1300 m_e, provisionally identified as κ mesons, are produced with a frequency comparable with that of the π mesons. Evidence for the creation of such heavy mesons is also provided by an observed decrease in the ratio of neutral π mesons to shower particles at very high energies. A method is described for measuring the lifetime of the neutral π meson, which takes advantage of the existence of an alternative mode of decay: $\pi^0 \rightarrow \gamma + \beta^+ + \beta^-$. It is shown that the proportion of π mesons which decay in this second mode is not greater than 4%. The preliminary observations suggest that the mean lifetime is about 10^{-14} sec. (auth)

5174
HALF LIVES OF μ^+ AND μ^- MESONS. N. Dallaporta. Nuovo cimento (9) 9, 449-52(1952) May. (In Italian)

Published data on the half life of μ mesons in various absorbers are collected and discussed. Half lives of $2.215 \pm 0.006 \times 10^{-6}$ sec for μ^+ and $\sim 2.5 \times 10^{-6}$ for μ^- are obtained by extrapolating adjusted values to zero absorber. Methods for improving these values are suggested. 19 references.

MOLECULAR PROPERTIES

5175
Knolls Atomic Power Lab.
CONVERGENCE OF INTERMOLECULAR FORCE SERIES, by Glenn W. Roe. [nd] 3p. (AECU-2132)

F. C. Brooks (Phys. Rev. 86, 92(1952)) proposes to modify the dipole-dipole and dipole-quadrupole contributions to the Van der Waals forces between He atoms, as calculated by second-order perturbation methods, by arbitrarily limiting the range of integration in the matrix elements to that region of space where the spherical harmonic expansion of the perturbing potential converges. The present calculation intends to show that the perturbation energy can be obtained from A. Unsold's calculations (Z. Physik 43, 563(1927)) for the H_2^+ ion without resort to expansion in spherical harmonics. The improved agreement with E. A. Hilleraas (Z. Physik 71, 739(1931)) which Brooks gets by his method seems to be a coincidence and does not correct for fundamental inadequacies. A table is presented giving various estimates of the second-order perturbation energy of H_2^+.

5176
Mallinckrodt Chemical Lab., Harvard Univ.
A NOTE ON ROTATIONAL LINE STRENGTHS IN SLIGHTLY ASYMMETRIC ROTORS, by David R. Lide, Jr. [nd] 10p. (NP-3955)

Direction-cosine matrix elements for slightly asymmetric rotors are calculated by a second-order perturbation treat-

ment around the limiting symmetric rotor. This permits evaluation of the line strengths which are involved in calculations of absorption intensities, Stark effects, and nuclear-quadrupole couplings in rotational spectra. Explicit formulas are derived for the first-order terms. (auth)

NEUTRONS

5177

Brookhaven National Lab.

NEUTRON CROSS SECTIONS, by AEC Neutron Cross Section Advisory Group. May 15, 1952. 203p. (AECU-2040)

This compilation presents the "best values" of the unclassified neutron cross sections, together with an estimate of error where practicable.

5178

THERMAL NEUTRON FLUX MEASUREMENTS IN GRAPHITE USING GOLD AND INDIUM FOILS. E. D. Klema and R. H. Ritchie. Phys. Rev. 87, 167(1952) July 1.

The observed activations of measuring foils in thermal-neutron flux determinations in diffusing media must be corrected for the attenuation of the neutron flux in the foil and for the flux depression caused by the presence of the foil. In order to obtain information directly about the perturbation of the flux by the foil, a series of In and one of Au foils was exposed in a slot of the ORNL graphite reactor in which the Cd ratio as measured with In foils is greater than 300. The γ activity of the foils was then counted. The saturated activity per unit thickness is plotted vs. thickness and compared with the theoretical curve of Bothe.

NUCLEAR PHYSICS

5179

Chalk River Project (Canada)

A PROPOSED METHOD FOR THE DIRECT MEASUREMENT OF THE MULTIPOLE CHARACTER OF ATOMIC AND NUCLEAR RADIATION, by J. W. Knowles. May 1952. 43p. (CRNE-497)

A method is proposed for determining the multipolarity of x and γ radiation by experimental means. The method consists of making the radiation emitted in two different directions by a random distribution of similar atoms interfere in a prescribed manner, so that the polar-diagram intensity pattern for one atom will not be averaged out when one considers the total mass of randomly oriented atoms. This could be accomplished with radioactive nuclei by growing a crystal of a mixture of the active isotope and an inactive isotope of the same element, the inactive component supplying the necessary bulk for crystal growth. A quantitative discussion is included with the purpose of determining the conditions under which experimental observations may be expected to be successful and of showing the present limitations of the method.

5180

SPIN-ORBIT COUPLING AND POLARIZATION OF NEUTRONS. M. Verde. Nuovo cimento (9) 9, 376-9(1952) Apr. (In Italian)

Direct determination of the spin-orbit coupling in the interaction potential of nuclear forces by measurement of the polarization of the neutrons from the d + d reaction is suggested. An expression for the polarization vector is derived, and methods for its experimental measurement are proposed.

5181

LIFETIMES OF ISOMERIC NUCLEI. Berthold Stech. Z. Naturforsch. 7a, 401-10(1952) June. (In German)

On the basis of the single-particle nuclear model, equations for the electric and magnetic multipole radiation by a nucleon in the average field of the nuclei are derived, and the resulting integrals are calculated. Term assignment following the single-particle model with strong spin-orbit coupling leads, especially for magnetic 2^4 pole transitions ($g_{9/2} \simeq P_{1/2}$; $h_{11/2} \simeq d_{3/2}$; $i_{13/2} \simeq f_{5/2}$), to an energy dependence for the transition probability in agreement with experiment. However, the theoretical transition probabilities are too large by an almost constant factor (~30).

5182

DEFINITION OF VIRTUAL LEVELS OF ATOMIC NUCLEI AND ESTABLISHMENT OF THE SCATTERING EQUATION. Jean Humblet. Mém. soc. roy. sci. Liège (4) 12, No. 4, 1-114(1952). (In French)

After examining critically the different definitions proposed for the virtual levels of a particle in a nuclear field, the author concludes that the ideas outlined by Siegert (Phys. Rev. 56, 750(1939)) constitute the best point of departure for a complete and convergent development of the scattering cross section. The mathematical method used is an application of the Mittag-Leffler theorem relative to meromorphic functions. Both s and l scattering are treated. The perturbation of virtual levels is discussed and applied to the problem of the virtual ^1S level of the deuteron.

NUCLEAR PROPERTIES

5183

Wyoming Univ.

NUCLEAR MAGNETIC RESONANCE PROJECT PROGRESS REPORT III [FOR] 1 SEPTEMBER, 1951 TO 15 MARCH, 1952; DETERMINATION OF THE ACCURACY OF THE INFINITELY REPEATED PULSE METHOD AND THE OBSERVED EFFECTS OF MOLECULAR SELF DIFFUSION IN LIQUIDS. [nd] 13p. (AECU-2130; PROGRESS REPORT III)

The range of measurements of nuclear magnetic resonance by the infinitely repeated pulse method is higher than the slow passage method of Bloch. As the measurements of T_2 approach 10^{-1} sec the effect of viscosity or self diffusion becomes important. For liquid hydrocarbons this effect is such as to make the previously measured values for liquid hydrocarbons subject to severe revision. Several possibilities have recently become apparent for making this improvement. (auth)

5184

Argonne National Lab.

STATES OF LIGHT NUCLEI FROM THE jj-COUPLING MODEL, by D. Kurath. June 1952. 13p. (AECU-2137; UAC-586)

The ordering of energy levels for nuclei in the 1p shell as given by the jj-coupling model can be obtained by using a Hartree method calculation. Previous investigators have studied the region extending from He^4 to O^{16} with the same method of calculation as for the L-S coupling model, in which spin-orbit forces are assumed to be small. Results of the present calculation, in which spin-orbit forces are assumed to be large, are presented in a form that facilitates comparison of the two models. Tables are presented giving matrix elements and quantum numbers for the potential energy of interaction in the 1p shell, ground-state spins and magnetic moments, and coulomb matrix within the p-shell.

5185

Brookhaven National Lab.

NUCLEAR ISOMERISM AND SHELL STRUCTURE, A REVIEW, by M. Goldhaber and R. D. Hill. Mar. 17, 1952. 231p. (BNL-1157)

Existing experimental data on nuclear isomers are brought together and discussed in the light of nuclear shell structure. Decay schemes, including spin and parity of nuclear levels, are given where possible. Regularities in the occurrence of isomers and in the variations of level positions among "families" of nuclear isomers are shown up and discussed. (auth)

5186
MASS CORRECTIONS TO HYPERFINE STRUCTURE. E. E. Salpeter and W. A. Newcomb. Phys. Rev. 87, 150(1952) July 1.

It is pointed out that the results reported previously by Low and Salpeter (Phys. Rev. 83, 478(1951)) for the contribution of nuclear motion to mass corrections to the hyperfine structure of H are incorrect. The complete results of the new calculation are given. Two types of correction terms arise, (1) one involving the exchange of a single transverse photon between the electron and proton, (2) the other the exchange of two transverse photons. The mass correction to the hfs of D is also calculated.

5187
MODULATION EFFECTS IN NUCLEAR MAGNETIC RESONANCE. James H. Burgess and Richard M. Brown. Rev. Sci. Instruments 23, 334-6(1952) July.

The perturbing effect of magnetic field modulation in nuclear magnetic resonance under conditions of high resolution is discussed. When the modulation frequency is greater than the resonance line width, sideband resonances separated in frequency by the modulation frequency are observed, having line shapes of either absorptive or dispersive form or a mixture of the two depending on the phasing of the lock-in detector. The form and distribution of these sidebands is satisfactorily accounted for using Bloch's equations. (auth)

5188
MASS OF V^{50}. Walter H. Johnson, Jr. Phys. Rev. 87, 166-7(1952) July 1.

The mass of V^{50} has been determined by the doublet method, C_4H_2 from butadiene being used for comparison. The mass doublets $C_4H_2-Cr^{50}$ and $C_4H_2-Ti^{50}$ were also measured. It was found that 2.39 ± 0.12 Mev is available for decay of V^{50} to Ti^{50}, and 1.18 ± 0.12 Mev for decay of V^{50} to Cr^{50}. Failure to detect this activity must be attributed to long half life.

5189
ISOMERS IN TELLURIUM 133. Alexis C. Pappas. Phys. Rev. 87, 162-3(1952) July 1.

A 2-min isomer of Te^{132} has been found in studies of the Te component of U fission products. A tentative decay scheme is proposed, whereby 63-min Te^{133m} decays to 2-min Te^{133} by emission of a highly converted >0.3-Mev γ, and Te^{133} then decays by 1.3- and 2.4-Mev β emission to excited states of I^{133}.

5190
DIFFERENTIAL CROSS SECTION FOR BREMSSTRAHLUNG AND PAIR PRODUCTION. L. C. Maximon and H. A. Bethe. Phys. Rev. 87, 156(1952) July 1.

The cross section for bremsstrahlung and pair production in the limit of high relativistic energies is calculated without the use of the Born approximation.

5191
INTEGRAL CROSS SECTION FOR BREMSSTRAHLUNG AND PAIR PRODUCTION. Handel Davies and H. A. Bethe. Phys. Rev. 87, 156-7(1952) July 1.

The differential cross sections for bremsstrahlung and pair production calculated in the preceding paper are integrated over angles. The correction to the Born approximation is proportional to Z^2 and amounts to a decrease of the cross section. The integrals are evaluated numerically for the case of Pb.

5192
THE RESONANCE LEVELS OF NITROGEN FOR ALPHA PARTICLES. Mustafa Cemil Karadeniz. Rev. faculté sci. univ. Istanbul A17, 1-18(1952) Jan. (In English)

The resonance levels of N for low-energy α particles were measured in a modified half-membraned Blackett-type cloud chamber filled with N_2 saturated with methyl alcohol and exposed to a well-collimated beam of Po α particles. In the 18,000 pairs of photographs taken under various pressures, 174 proton tracks were observed. Nine resonance levels corresponding to 5.5, 8.5, 10.5, 13.5, 15.5, 17.5, 21.5, 23.5, and 25.5 mm in α-particle range were found. The maximum in each of the proton angular-distribution curves corresponding to energies of $E < 2$ Mev, $2 < E < 3.5$ Mev, and $E > 3.5$ Mev occurred at 80° in the laboratory system.

5193
EXCITED STATES OF Mg^{25} FROM THE $Al^{27}(d,\alpha)Mg^{25}$ AND $Mg^{24}(d,p)Mg^{25}$ REACTIONS. P. M. Endt, H. A. Enge, J. Haffner, and W. W. Buechner. Phys. Rev. 87, 27-30(1952) July 1.

The alpha-particle groups from thin aluminum targets bombarded with 1.8-, 2.0-, and 2.1-Mev deuterons have been studied with a high-resolution magnetic spectrograph. Eleven of these groups have been assigned to the $Al^{27}(d,\alpha)Mg^{25}$ reaction, corresponding to the ground state and ten excited states of Mg^{25} in a region of excitation from zero to 4.0 Mev. The proton groups from a thin natural magnesium target were also studied at deuteron bombarding energies of 1.5, 1.8, and 2.0 Mev. Eleven of the observed proton groups could be assigned to the $Mg^{24}(d,p)Mg^{25}$ reaction, corresponding to the transition to the ground state of Mg^{25} and the same ten excited levels found from the $Al^{27}(d,\alpha)Mg^{25}$ reaction. The excited states in Mg^{25} found from these two reactions are at 0.583, 0.976, 1.611, 1.957, 2.562, 2.736, 2.799, 3.405, 3.898, and 3.969 Mev. (auth)

5194
SPINS OF LEVELS OF EVEN-EVEN NUCLEI AND THEORY OF α EMISSION. Salomon Rosenblum and Manuel Valadares. Compt. rend. 234, 2359-61(1952) June 9. (In French)

In the five cases of even-even α-γ emitters studied in most detail, i.e., Io (Th^{230}), Ra^{226}, RdTh (Th^{228}), ThX (Ra^{224}), and Po^{210}, the first excited state of the daughter has spin 2. In those cases with two excited states the second has spin 4. Gamow's equation is shown to give systematically low values for the intensity of the α fine structure corresponding to these spins.

5195
NUCLEAR MAGNETIC RESONANCE IN AN ANTI-FERROMAGNETIC SINGLE CRYSTAL. II. N. J. Poulis and G. E. G. Hardeman. Physica 18, 315-28(1952) May. (In English; cf. NSA 6-4206)

The decomposition of the proton magnetic resonance line in an antiferromagnetic single crystal of $CuCl_2.2H_2O$ in different magnetic fields in the transition region is discussed. With different orientations of fields of 4170 and 5970 gauss in the ab-plane of the crystal the resonance diagrams are perturbed sine functions with periods of 360°. The perturbation is more pronounced in stronger fields. In a field of 7460 gauss the transition of a perturbed sine function with a period of 360° into one with a period of 180° is studied as a function of temperature. (auth)

NUCLEAR REACTORS

5196
NUCLEAR REACTOR CATALOG. H. S. Isbin. Nucleonics 10, No. 3, 10-16(1952) Mar.

A chart summarizes the unclassified features of reactors which are already in operation or are in advanced stages of design of construction. Included are reactors in the U. S., England, France, Canada, and Norway. 44 references.

5197
STATISTICAL SAMPLING OF FUELS. F. Proschan and S. B. Roboff. Nucleonics 10, No. 7, 32-3(1952) July.

A random sampling plan mathematically calculated to determine the average quality of large numbers of fuel elements is

described. The plan is illustrated and general formulas used are given.

5198
CANADIAN FACILITIES FOR ISOTOPE PRODUCTION AND BOMBARDMENT. F. W. Gilbert. Nucleonics 10, No. 1, 6-8(1952) Jan.

The limitations and capabilities of the NRX reactor are discussed. Qualitative consideration is given to the effect of the cross section of the material being irradiated and to the question of neutron economy. The flux distribution for a cross section through the center of the NRX is shown.

NUCLEAR TRANSFORMATION

5199
ANGULAR DISTRIBUTION OF PHOTOPROTONS FROM CARBON. J. Halpern, A. K. Mann, and M. Rothman. Phys. Rev. 87, 164-5(1952) July 1.

The angular distributions of photoprotons from a 38 mg/cm^2 target of C^{12} irradiated with bremsstrahlung of maximum energy 23 Mev have been determined. The results are presented graphically. The distribution shows a large asymmetric component peaked in the forward direction and can be fitted by an expression of the form $1 + (a\sin\theta + b\sin\theta\cos\theta)^2$, representing dipole and quadrupole interference terms. The amount of quadrupole absorption at these energies is about 1%.

5200
INVESTIGATION OF THE (d,p) AND (d,α) REACTIONS OF THE SILICON ISOTOPES. D. M. Van Patter and W. W. Buechner. Phys. Rev. 87, 51-9(1952) July 1.

An investigation of the $Si^{29}(d,\alpha)Al^{27}$, $Si^{29}(d,p)Si^{30}$, and $Si^{30}(d,p)Si^{31}$ reactions has been made using a high-resolution magnetic spectrograph. The spectra of particle groups observed at 90 degrees to the incident deuteron beam from silicon-dioxide targets enriched in Si^{29} and Si^{30} were compared to the spectra obtained from targets of natural SiO_2. The Q-values for the ground-state transitions are 5.994 ± 0.011, 8.388 ± 0.013, and 4.364 ± 0.007 Mev. The following level positions have been determined: Al^{27}, 0.84 and 1.01 Mev; Si^{30}, 2.24, 3.51, and 3.79 Mev; and Si^{31}, 0.757, 1.699, 2.319, 2.751, 3.140, 3.539, and 4.384 Mev. In addition a survey of the $Si^{29}(d,p)Si^{29}$ reaction to lower proton energies has indicated levels in Si^{29} at 5.946, 6.105, and 6.380 Mev. (auth)

5201
ANGULAR DISTRIBUTIONS OF PHOTOPROTONS. A. K. Mann, J. Halpern, and M. Rothman. Phys. Rev. 87, 146-9 (1952) July 1.

The angular distributions of photoprotons from Cu, Ni, and Co targets irradiated with bremsstrahlung of 23-Mev maximum energy have been measured. Protons from Cu and Co show a large asymmetric component which is described by the expression $(\sin\theta + 0.5\sin\theta\cos\theta)^2$. Absorption experiments on the protons are consistent with the assignment of the asymmetric component to transitions involving discrete levels in the vicinity of the ground state of the residual nucleus. The angular distributions observed are interpreted as resulting from interference between electric dipole and quadrupole absorption of the initial photons with the relative quadrupole intensity equal to 5 percent. (auth)

5202
SUM RULES IN THE DISPERSION THEORY OF NUCLEAR REACTIONS. T. Teichmann and E. P. Wigner. Phys. Rev. 87, 123-35(1952) July 1.

In the first five sections the dispersion theory is developed with an internal region V whose boundary S is quite close to the nuclear surface. Two types of quantities then occur: those like the derivative matrix R, which connect the values and derivatives of the wave function at S, and those like the collision matrix U which give the asymptotic behavior of the wave function. These latter are, of course, independent of the position of S. Because of the proximity of S to the nuclear surface, the wave function in the closed channels and its derivative remain appreciable at S. They may, however, be eliminated from the formalism, and this is done in Sec. II, leading to a reduced R which connects the values and derivatives of the wave function in the open channels only. In the next section this reduced R is used to obtain expressions for the S-independent quantities, in particular, for the collision matrix. These expressions are given more explicit, but approximate, form in Sec. IV. The development shows that the quantity, which in the usual formulas for the cross sections is interpreted as the nuclear radius, need not be equal to this at all, but is the distance at which two opposite effects compensate. The fifty section gives exact expressions for the poles and residues of some S-independent quantities, which are then compared with the poles and residues of the approximate expressions of the previous chapter. In this way criteria are derived for the accuracy of these approximate expressions. The last sections contain derivations of two sum rules for the parameters in the original R. The consequences of these sum rules are traced for the reduced R and for the S-independent quantities, in the light of the development of the first five sections. The first sum rule gives a maximum for the partial widths of levels, while the second leads to the well-known proportionality of reduced level width and level spacing. The meaning and validity of this is discussed in some detail, both for the single-particle and many-particle pictures. (auth)

5203
THE ANGULAR DISTRIBUTION AND EXCITATION FUNCTION OF THE LONG-RANGE PROTONS FROM THE Be^9(d,p)Be^{10} REACTION. Frederick L. Canavan. Phys. Rev. 87, 136-40(1952) July 1.

The angular distribution of the long-range protons from the deuteron bombardment of Be^9 has been investigated over the deuteron energy range from 1.0 to 2.2 Mev using a photographic technique. The excitation function has been measured from 0.55 to 2.95 Mev using a proportional counter. On the basis of a compound-nucleus model, the fact that six terms are required to fit the observed distributions with a series of Legendre polynomials indicates the presence of overlapping levels of the compound nucleus in the region with both even and odd parities, and that both d and f deuterons enter into the reaction at these energies. There is, however, some evidence that the reaction proceeds in part by a stripping process with the transfer of a neutron with $l = 1$ to the target nucleus. This stripping becomes relatively more important as the deuteron energy is increased. The excitation function shows evidence of broad, overlapping resonances. (auth)

PARTICLE ACCELERATORS

5204
AN INTEGRATING DEVICE FOR HIGH-INTENSITY ION CURRENTS. R. Querzoli. Rend. ist. super. sanità 14, 792-9(1951). (In Italian)

An integrating circuit for measuring the total number of ions arriving at the target of an ion accelerator during a given time is diagramed. It is suitable for beam currents of 1 to 1100 μa.

5205
TESTED REALIZATION OF AN ELECTRIC GENERATOR FOR NUCLEAR RESEARCH WITH VERY HIGH VOLTAGE AND A STREAM OF DUST. Max Morand, André Raskin, and Léon Winand. Compt. rend. 234, 2450-2(1952) June 16. (In French)

An electrostatic generator of the type first described by Pauthenier and Moreau-Hanot (J. phys. radium (7) 8, 193 (1937)) has been operated successfully for 5 yr. This generator is similar to a Van de Graaff accelerator, but charging of the sphere is accomplished by an ionized current of air containing extremely fine dust (in the present case, glass powder). Problems of collector supports, charge on the dust particles, insulator construction, choice of powder, air flow, and refrigeration are discussed. The generator discharges at >1 Mv and 1 ma.

5206
AN ION SOURCE. Detlef Kamke. Z. Naturforsch. 7a, 341-4(1952) May. (In German)

An ion source for gaseous ions is described, capable of yielding a 700-μa H-ion beam of 20-kev energy for an energy input of 90 watts.

5207
POSSIBILITIES OF HEAVY ION BOMBARDMENT IN NUCLEAR STUDIES. G. Breit, M. H. Hull, Jr., and R. L. Gluckstern. Phys. Rev. 87, 74-80(1952) July 1.

Bombardment of nuclei by multiply charged ions of medium atomic weight such as C^{12} or O^{16} is considered as a possible means of studying nuclear structure. Estimates are made regarding the approximate magnitude of: (a) distortion effects in target nuclei produced by the incident particles, (b) consequences of the distortion such as effects on thresholds of reactions having their origin in coulomb barriers, (c) stimulation to fission, (d) effects characteristic of the leakage of neutrons and protons out of the two colliding nuclei by wave-mechanical penetration of the regions of negative kinetic energy; an exploration of these effects should amount to a study of the halo of neutrons and protons surrounding the more compact nuclear interior and might be helpful in determining the number of nuclear particles at the nuclear surface having a given energy. The treatment is qualitative and the mathematical discussion involves many approximations. General design characteristics of a 60-inch cyclotron that should be capable of imparting the necessary energy to multiply charged ions are considered. (auth)

5208
THE ELECTROSTATIC OR VAN DE GRAAFF GENERATOR. W. L. Buys. Tech. Wetenschap. Tijdschr. 21, 117-30(1952) June. (In Dutch)

The various types of Van de Graaff generators are described briefly and sketched. 10 figures.

5209
THE COSMOTRON - IT WORKS. Nucleonics 10, No. 7, 34-5(1952) July.

A proton energy of 2.25 Bev has been reached in the cosmotron at Brookhaven National Laboratory. History and construction costs are mentioned very briefly. Six photographs are included.

5210
NUMERICAL CALCULATION OF THE ELECTROMAGNETIC FIELD IN LINEAR ION ACCELERATORS. Michel Bernard. Compt. rend. 234, 2175-8(1952) May 26. (In French)

Exact expressions derived by the author (Compt. rend. 234, 1862-5(1952); NSA 6-4232) are put in a form suitable for calculation. The series obtained are difficult to evaluate in the general case. Knowledge of the order of magnitude of the parameters permits simple approximate expressions to be obtained for the axial field.

5211
TARGET ASSEMBLY FOR CYCLOTRON IRRADIATION OF LIQUIDS. William R. McDonell and A. S. Newton. Nucleonics 10, No. 1, 62, 64(1952) Jan.

A description and diagrams are presented of the liquid-target assembly designed and built to study the chemical products formed during bombardment of aliphatic alcohols with high-energy particles in the UCRL 60-in. cyclotron.

RADIATION ABSORPTION AND SCATTERING

5212
Los Alamos Scientific Lab.
ELASTIC SCATTERING OF 9.7-MEV PROTONS BY DEUTERIUM AND BY HYDROGEN, by J. C. Allred, A. H. Armstrong, R. O. Bondelid and Louis Rosen. [nd] 23p. (AECU-2123; LADC-1216)

The p-d and p-p differential scattering cross sections have been measured with a 9.7-Mev cyclotron external proton beam and with photographic plates as detectors of the scattered particles. In both interactions the angular distributions are similar to those observed at lower energies, and the total cross sections are in good agreement with reasonable extrapolations of the low-energy data. The p-d data show some evidence for deuteron disintegration. Neglecting spin-orbit coupling, the p-p data are consistent with pure S-wave scattering with a phase-shift of 57.8° ± 1.2°. (auth)

5213
Los Alamos Scientific Lab.
D-D PLASTIC SCATTERING AT 10.5 MEV, by Louis Rosen and J. C. Allred. [nd] 10p. (AECU-2124; LADC-1217)

Deuterons of energy 10.5 ± 0.15 Mev from the 42-inch cyclotron were scattered by a thin deuterium gas target. Scattered particles were detected by photographic emulsions in a nuclear multiplate camera. The differential cross section for elastic scattering was measured at 5° intervals in the center-of-mass system, from 25° to 145°, the estimated absolute rms standard error of the measured cross sections being ±3.1 percent. The measurements extend the angular range of the previous measurements of Allred, Erickson, Fowler, and Stovall (Phys. Rev. 76, 1430(1949)) at 10.8 Mev, and are in very good agreement with their values when the difference in bombarding energy is taken into account. (auth)

5214
Los Alamos Scientific Lab.
INELASTIC COLLISION CROSS SECTIONS FOR 14-MEV NEUTRONS, by D. D. Phillips, R. W. Davis and E. R. Graves. [nd] 13p. (AECU-2129; LADC-1224)

The inelastic-collision cross sections of B, C, N, Al, Fe, Cu, Cd, Au, Pb, and Bi for 14-Mev neutrons from the D(t,n) reaction have been measured. Threshold detectors were placed inside spherical shells of the scattering material. Reactions in Cu, Al, and P with thresholds at ~11.5, 2.6, and 1.4 Mev were used as threshold detectors. The data are best fitted empirically by the relation $\sigma = \pi R^2$, where $R = (2.5 + 1.1\ A^{1/3}) \times 10^{-13}$ cm.

5215
Chalk River Project (Canada)
THE THEORY OF NEUTRON DIFFRACTION BY GASES I, by N. K. Pope. May 1952. 61p. (CRT-505)

An expression for the total, elastic and inelastic, differential cross section for scattering of thermal neutrons by a rigid polyatomic molecule is derived. In summing over the final rotational states of the molecule the change in energy of the neutron is assumed negligibly small compared to the neutron's initial energy. The validity of this approximation is discussed. The rigidity of the molecule is then relaxed and the expression obtained for the cross section amended to take account of the vibrational motion of the nuclei. It is shown that the elastic scattering from a vibrating molecule is equivalent to that from a set of uncoupled anisotropic oscillators placed at the mean nuclear sites. Detailed results are given for spherical top molecules of the type YX_4. Good agreement is found with the experimental pattern of carbon tetrafluoride but not with that of methane. (auth)

5216

IONIZATION LOSS AT RELATIVISTIC ENERGIES AND POLARIZATION EFFECTS. M. Schönberg. Nuovo cimento (9) 9, 372-5(1952) Apr. (In English)

The present theory of ionization loss by relativistic charged particles predicts an important emission of Cherenkov radiation, which, however, has not been observed in experiments. By modifying the usual method of taking polarization effects into account, the author derives expressions for ionization loss which clearly separates the contributions of direct ionization and excitation and the emission of Cherenkov radiation. The experimental results are thereby explained.

5217

ABSORPTION COEFFICIENTS OF GAMMA-RAYS. S. J. Wyard. Phys. Rev. 87, 165(1952) July 1.

The absorption coefficients for C, Al, Cu, Mo, Ag, W, Pb, U, and H_2O have been measured. The isotopes Hg^{203}, Cr^{51}, Ru^{103}, Rb^{88}, Co^{60}, and K^{42} were used as sources of γ radiation. The tabulated experimental values are compared with theoretical values calculated in the usual way. There is good agreement for elements of low atomic number, but the measured values for W, Pb, and U at the higher energies are significantly smaller than the theoretical values. The error in the calculations of Hulme et al. (Proc. Roy. Soc. (London) A149, 131(1935)) for the photoelectric coefficient is stated for each γ energy, on the assumption that the discrepancy is not due to errors in the Klein-Nishina formula for compton scatter or the Bethe and Heitler values of the pair-production coefficient.

5218

GAMMA-RAY-DIFFUSION EXPERIMENTS IN WATER. M. A. Van Dilla and G. J. Hine. Nucleonics 10, No. 7, 54-8 (1952) July.

Radium, Hg^{203}, Co^{60}, and Au^{198} were used in experimentally determining the field of small γ-ray sources in a large water medium. The experimental arrangement is described, results are given of intensity vs. water level and intensity vs. source-chamber separation measurements, and a dosage factor is calculated.

5219

X-RAY ENERGY CONCEPTS AND UNITS. A. F. Neboschew. Fortschr. Gebiete Röntgenstrahlen 76, 781-95(1952) June. (In German)

The more important x-ray energy values are described from a physical-technical point of view. These values are distinguished as to efficiency and energy values. The ideas of specific energy and absorption as a consequence of the irradiation are contrasted with the concept of dose and dose efficiency, and previously used methods referring these values to volume are quantitatively assessed in terms of the modern referrence to mass.

5220

SINGLE SCATTERING OF ELECTRONS BY ATOMS. E. Kinzinger and W. Bothe. Z. Naturforsch. 7a, 390-401(1952) June. (In German)

Measurements of single scattering of 245-kev electrons in metal foils are described. Effect of multiple scattering is discussed. Single scattering in Ni, Ag, and Au were measured relative to Al, the angular distribution was measured in Al, and an absolute measurement of the scattering cross section in Al at a scattering angle of 50° was made. Mott's absolute values of the cross section for Al for θ = 30 to 150° and for the higher-Z elements for $\theta < 70°$; were confirmed. The measured cross sections for the higher elements and for $\theta > 70°$ were smaller than theoretical values. The deviation increased with θ and Z, reaching 37% for Au at 150°. Possible origins for these deviations are discussed.

5221

AN OPTICAL MODEL FOR NUCLEON-NUCLEI SCATTERING. Robert E. Le Levier and David S. Saxon. Phys. Rev. 87, 40-1(1952) July 1.

An optical model for the scattering of nucleons by nuclei has been investigated. The model is one in which the interaction is described by a complex square-well potential $V(r) = -V_0 - iW_0$, $r < R_0$. Comparison with experiment indicates that for the scattering of 18-Mev protons by Al, reasonable agreement is obtained using well parameters which are consistent with the requirement of the transparency model and of low-energy neutron scattering. The boundary-condition model of Feshbach and Weisskopf has also been examined and a region of quasi-equivalence indicated for the two models. (auth)

5222

SCATTERING BY MANY-BODY SYSTEMS IN TERMS OF TWO-BODY COLLISION PARAMETERS. H. Ekstein. Phys. Rev. 87, 31-9(1952) July 1.

The scattering of a particle by a system of N particles is described without approximation by a set of equations not containing the interaction hamiltonian, but an infinite set of two-body collision parameters which can be obtained from solving two-body problems. These equations, obtained with the assumption of two-body potential interaction between particles, can be applied to the case where the scattering particles are themselves complex systems, provided that the relevant two-body collision parameters are known or inferred from experiment. In the simplest case where the only relevant parameter is the scattering length, the first approximation is Fermi's result for the scattering of slow neutrons by protons. The "impulse approximation" is shown to be an approximate form of the present first approximation. It is shown that previous approximation schemes, in general, fail to give convergent higher approximations for the limiting case of point scatterers, whereas the present equations give convergent higher terms. It can be concluded that the latter are particularly appropriate for short-range interaction. The matrix α which contains all necessary two-body collision parameters is expressed in terms of solutions of the ordinary free two-body scattering problem. The result is applied to derive a revised theory of refraction and diffraction of slow neutrons in crystals by including the effect of zero-point motion of the nuclei and the electrostatic interaction between neutrons and electrons. (auth)

5223

SECONDARY ELECTRON EMISSION AND EFFECTIVE ATOMIC NUMBERS. Gerald J. Hine. Nucleonics 10, No. 1, 9-15(1952) Jan.

Measurements have been made of the forward and backscattered secondary-electron emission of various materials when irradiated with the γ rays of Ra or one of several artificial nuclides. The various γ sources were placed inside a lead cone which collimated the γ rays through two adjacent ionization chambers. With the exception of a lucite bottom plate, the chamber walls were made of very thin Al supported by four rods at the corners of each chamber. Absorbers of various materials were put vertically into the 1-cm-wide opening between the two chambers. For each γ energy the absorber thickness was chosen approximately equivalent to the range of the secondary electrons. Formulas are derived by which the effective atomic numbers for a material of known composition can be calculated from the measured secondary-electron emission. The effective atomic number of bone for the absorption of γ rays by the photoelectric process, by pair production, or by backwards emission of secondary electrons is determined.

5224
MULTIPLE SCATTERING OF 0.59 MEV ELECTRONS. E. Hisdal. Phil. Mag. (7) 43, 790-800(1952) July.

The multiple scattering of electrons of 0.59-Mev kinetic energy in G5 plates has been investigated. The experimentally determined mean of the absolute multiple scattering angle is found to be significantly lower than the value predicted by theory. (auth)

RADIATION EFFECTS

5225
Brookhaven National Lab.
EFFECT OF RADIATION ON ELASTIC CONSTANTS, by G. J. Dienes. June 30, 1952. 2p. (BNL-1200)

F. R. N. Nabarro proposes an estimate of lattice distortion due to radiation based on an average derived from the theory of elasticity of an isotopic medium. G. J. Dienes comments on Nabarro's calculations. In his original paper (Phys. Rev. 36, 228(1952)), the writer underestimated the decrease in elastic moduli caused by vacant lattice sites. The writer believes that Nabarro underestimates the influence of the interstitials by underestimating the effect volume over which the elastic moduli are greatly increased. 1% interstitials increase the shear modulus by 6.3% and 1% vacancies decrease the shear modulus by 1.5%.

5226
MECHANISM OF SCINTILLATION IN ORGANIC CRYSTALS. M. Ageno and R. Querzoli. Rend. ist. super. santità 14, 779-91(1951). (In Italian)

Three processes capable a priori of accounting for the phenomenon of scintillation in organic crystals are (1) electronic excitation of the crystal, (2) ionization of the molecules, and (3) excitation of the molecules followed by migration of excitation energy through the crystal. The available experimental data on decay of fluorescence, effect of temperature on average life of fluorescence, conductivity associated with scintillations, and transparence of crystals to their fluorescent light are examined qualitatively. Only hypothesis (3) is not contradicted by any experimental data.

5227
FLUORESCENCE PRODUCED BY ALPHA PARTICLES IN STILBENE. M. Ageno and G. Cortellessa. Rend. ist. super. sanità 15, 159-61(1952). (In Italian)

By means of the same photographic technique previously used for solutions, the authors demonstrate that in crystals of trans-stilbene excited by Po α particles, the energy travels for several millimeters before being transformed into fluorescent light.

RADIOACTIVITY

5228
Radiation Lab., Univ. of Calif.
THE ALPHA SPECTRA OF Pu^{239} AND Pu^{240}, by Frank Asaro and I. Perlman. May 15, 1952. Decl. July 17, 1952. 18p. (AECD-3420; UCRL-1821)

Utilizing a magnetic alpha-particle spectrograph the complex alpha spectrum of Pu^{239} was found to consist of three groups; α_0 (69%), α_{13} (20%) and α_{51} (11%). The spectrum of Pu^{240} consisted of two groups, α_0 (76%) and α_{44} (24%). The nomenclature α_x refers to that alpha group which leaves the product nucleus with an energy of x kev above the ground state. The alpha-particle energy of α_0 of Pu^{239} was measured as 5.150 ± 0.002 Mev and that of Pu^{240} at 5.162 ± 0.004 Mev. These values are correlated with the gamma rays and conversion electrons observed by other workers to form a partial decay scheme. (auth)

5229
Brookhaven National Lab.
THE DECAY OF Rh^{106}, by David E. Alburger. [nd] 21p. (BNL-1196)

An abstract of this report was indexed as report AECU-1623 and appears in Nuclear Science Abstracts as NSA 5-6486.

5230
Rochester Univ.
THE GROUND STATE PARITY OF N^{14}, by D. A. Bromley. June 12, 1952. 23p. (NYO-3211)

Four-Mev deuterons from the Rochester 27-in. cyclotron have been used to determine the angular distribution of the neutrons from the $C^{13}(d,n)N^{14}$ ground state reaction for laboratory angles less than 45°. Similar measurements have been made on the $Be^9(d,n)B^{10}$ and $F^{19}(d,n)Ne^{20}$ ground state reactions, primarily to confirm the applicability of the Butler stripping theory at this energy and with this particular experimental arrangement. Comparison of the experimental results with the predictions of the theory shows that there is a parity change in the $C^{13}(d,n)N^{14}$ and $Be^9(d,n)Ne^{20}$ reactions and no parity change in the $F^{19}(d,n)Ne^{20}$ reaction. Since the C^{14} and C^{13} ground states have been previously shown to have opposite parity, there can be no parity change in the C^{14} beta decay. (auth)

5231
Oak Ridge National Lab.
THE INTERNAL CONVERSION CORRELATION FOR MIXED CONVERSION TRANSITIONS, by M. E. Rose and L. C. Biedenharn. Issued July 25, 1952. 9p. (ORNL-1324)

In a recently published paper (Phys. Rev. 85, 5(1952)) the angular correlation problem in a double cascade in which one or both transitions involve the emission of a conversion electron was treated. In the aforementioned work the restriction to pure multipoles for the conversion transition was made. The purpose of this report is to make the extension to the case in which the conversion transition is a mixture, and results are presented for the practical case of a mixture of 2^L-pole magnetic plus 2^{L+1}-pole electric radiation.

5232
Radiation Lab., Univ. of Calif.
ISOMERIC TRANSITIONS IN Tc^{92} AND Tc^{96}, by Heinrich A. Medicus and Harry T. Easterday. Apr. 18, 1952. 11p. (UCRL-1518)

Mo oxide enriched in Mo^{92} was bombarded with 9.5-Mev protons. The Tc activities were separated and the K/L ratio and conversion coefficient for the 390-kev transition in Tc^{92} were determined by means of a β spectrometer. The 390-kev transition was shown to be a M4 isomeric transition. By bombarding enriched Mo oxides with 9.5-Mev protons it has been possible to fix the mass number of the Tc isomer of 51.5 ± 1.0-min half life and 31.4-kev transition energy. The transition is assigned to Tc^{96} and a weak positron branching was found.

5233
NUCLEON-LEPTON INTERACTION IN β-DECAY. R. Nataf and R. Bouchez. Phys. Rev. 87, 155(1952) July 1. (cf. J. phys. radium 13, 37S-38S(1952))

An analysis of the nuclear matrix element for allowed β transitions in light nuclei is presented. It indicates that the β-disintegration interaction must be (T,V), (T,S), or (A,V). The nuclear matrix element is M, where $|M|^2 \equiv |C_f|^2|M_f|^2 + |C_t|^2|M_t|^2$. The results of the analysis give $|C_f|^2 \simeq 0.20$ and $|C_t|^2 \simeq 0.80$. A summary of data on mirror nuclei, which was used in the analysis, is given.

5234
INTERNAL CONVERSION OF γ-RAYS WITH PAIR PRODUCTION. S. A. S. Brimberg. Phys. Rev. 87, 150-1(1952) July 1.

The problem of the internal-pair-formation coefficient was treated "exactly" by Jaeger and Hulme (Proc. Roy. Soc. (London) 148, 708(1935)). This theory has now been used as a basis for a numerical calculation corresponding to the nuclear reaction $Co^{60}\beta^- \rightarrow Ni^{60*}\gamma \rightarrow Ni^{60}$. The γ energy is 1.31 Mev = 2.57 mc^2, and Z = 28. The internal-pair-formation coefficients obtained by Jaeger and Hulme and by the author are tabulated for Z = 0, 28, and 84. Both dipole and quadrupole radiations are included. The new calculations show that the dependence on Z is not even roughly linear. Interpolation formulas are given by which an estimate of the coefficient at different Z in the energy region 2 to 5 mc^2 may be obtained.

5235
RUTHENIUM 94. A. van der Wiel and A. H. W. Aten, Jr. Physica 18, 356(1952) May. (In English)

A Ru fraction was isolated by distillation from a Mo compound bombarded with 52-Mev He ions. Comparison of the activity of consecutive fractions containing Tc^{94} precipitated from the Ru preparations showed the half life of Ru^{94}, probably formed by the Mo^{92} (α,2n) and Mo^{94} (α,4n) reactions, to be ~57 min. The radiations of Ru^{94} were not studied directly.

5236
THE ANGULAR CORRELATION OF TWO GAMMA QUANTA EMITTED BY ALIGNED RADIOACTIVE NUCLEI. J. A. M. Cox and H. A. Tolhoek. Physica 18, 359-60(1952) May. (In English)

Equations are given for angular correlation of successive dipole and successive quadrupole transitions in aligned nuclei, the latter specifically for Co^{60}.

5237
ANGULAR DISTRIBUTION AND POLARIZATION OF GAMMA RADIATION EMITTED BY ALIGNED RADIOACTIVE NUCLEI. H. A. Tolhoek and J. A. M. Cox. Physica 18, 357-8(1952) May. (In English)

Equations are given for angular distribution and polarization of dipole and quadrupole radiation, suitable for discussions of the γ radiation emitted by Co^{60} sources with nuclei aligned by very low temperatures.

SPECTROSCOPY

5238
Los Alamos Scientific Lab.
A CEMENT BASE FOR THE HOT FILAMENT MASS SPECTROMETER SOURCE, by John E. Hand. [nd] Decl. July 17, 1952. 4p. (AECD-3419; LADC-1210)

Sauereisen cement, No. 1 paste, was found to be satisfactory in furnishing a porous, unglazed porcelain-like base upon which to deposit U and Pu sample material for satisfactory adherence to Ta ribbon filaments. Properties of the cement and the method used for sample preparation are discussed.

5239
Carbide and Carbon Chemicals Co. (K-25)
THE PREPARATION AND INFRA-RED TRANSMISSION OF THIN FILMS OF SOME INORGANIC SULFIDES, by A. E. Cameron. Issued July 9, 1952. 19p. (K-911)

Infra-red transmission from 1 to 15 μ has been determined for thin films of some inorganic sulfides prepared by simultaneous evaporation of metal and elemental sulfur. The sulfides of silver, tin, antimony, germanium and bismuth transmit infra-red, but those of iron and copper do not. Some potentially useful applications of this method of preparing films are suggested. Transmissions of these films in the visible region are given in an appendix. (auth)

THEORETICAL PHYSICS

5240
Naval Research Lab.
APPLICATION OF THE FRANCK-CONDON PRINCIPLE TO COMPLEX SYSTEMS, by Melvin Lax. June 17, 1952. 19p. (NRL-3973)

The semiclassical Franck-Condon principle is derived from the usual quantum-mechanical transition probability by the application of a mean-value theorem and closure to the summation over final and initial vibrational states. In order to provide an accuracy test of the semiclassical formula as well as to lay the groundwork for a number of important applications, the following problem was considered: Absorption or emission by a complex system whose vibrational states are describable by normal modes, such that the configurational energy difference between the two electronic states can be approximated by a linear expression in the normal coordinates. (The last assumption often corresponds to the maximum accuracy with which the electronic energy can be computed.) It was found possible to solve this basic problem in closed form using quantum-mechanical as well as semiclassical procedures. The semiclassical Franck-Condon principle yielded a gaussian absorption (or emission) spectrum whose mean value (~peak) and breadth were in exact agreement with the corresponding quantum-mechanical parameters. The quantum-mechanical spectrum, however, is not precisely gaussian. It possesses a skewness (third moment) that is positive for absorption and negative for emission (i.e., the high-energy tail is longer on absorption). This effect is produced by the Stokes rule, which states that it is easier to emit a phonon than absorb one. And the kurtosis of the quantum-mechanical curve (fourth moment) is larger than that expected for a guassian. Thus for the same rms width, the quantum-mechanical curve is flatter and longer-tailed. Another problem that has been investigated is the extent to which a complex system can, as is customary in Franck-Condon calculations, be replaced by a one-parameter system. It was established that a one-parameter description is possible if the energy separation between the two electronic states (whether linear or not) is a function only of a single parameter. It was demonstrated, however, by comparison with the exact calculations mentioned above, that the effective resonance frequency of the one-parameter (harmonic oscillator) system would be temperature dependent. Approximate calculations are made for this resonant frequency when the energy difference between the two electronic states contains a quadratic term. (NRL abst.)

5241
A REMARK ON THE UNIQUENESS OF THE POTENTIAL DETERMINED FROM THE ASYMPTOTIC PHASE. B. Holmberg. Nuovo cimento (9) 9, 597-604(1952) July. (In English)

It is shown that the impossibility of determining the potential between two particles from the asymptotic phases when there exist also bound states, comes from the fact that it is not possible to extend the orthogonality relations given by Fröberg (NSA 2-230, 3-2339) and Hylleraas (NSA 1-513) to the discrete eigenfunctions. An expression in terms of these functions is given for the difference between two phase-equivalent potentials with the same energy spectrum. Finally, in the case when only one bound state exists, an explicit formula is given for constructing this difference if one special potential and its corresponding eigenfunction is known. (auth)

5242
A REFORMULATION OF FIELD THEORY. H. C. Corben. Nuovo cimento (9) 9, 580-96(1952) July. (In English)

An alternative formulation is given for the quantum theory of fields in which the charge on a particle is introduced as an operator rather than as a number. In addition to the advantage of mathematical simplicity, this formulation allows the fundamental properties of charge quantization and charge conservation to be deduced from the one hypothesis introduced to replace that of gauge invariance of the first

kind. Systems of particles of different mass and charge may be treated more elegantly by this method, which is identical with the usual one for particles of spin zero, but which leads to a generalized Dirac equation which could be applied, for instance, to a mixed electron and neutrino field. This equation is very simply expressible in terms of modified field-dependent Dirac operators, and leads to oscillations of the specific charge of a particle analogous to the Zitterbewegung. (auth)

5243
THE GAUGE INVARIANCE PROBLEM. Hartland S. Snyder. Phys. Rev. 87, 164(1952) July 1.

It is shown that the formulation by Tomonaga (Progress Theoret. Phys. (Japan) 1, 27(1946)) and Schwinger (Phys. Rev. 75, 651(1949)) of electrodynamics in the interaction representation is not gauge invariant. The definition of the basis vectors of the representation in terms of a separation of the interaction-free electron-positron field into positive and negative frequency parts does not give a gauge-invariant representation.

5244
THE INFLUENCE OF RELATIVISTIC CORRECTIONS UPON SINGULAR NUCLEAR POTENTIALS. J. Werle. Phys. Rev. 87, 159-60(1952) July 1.

A method of successive approximations is presented for taking into account relativistic effects in deducing, from meson field theories, the static interaction potential between nucleons. This method operates consistently in the configuration space, thus eliminating a major disadvantage of previous computations. It can also be interpreted within the framework of quantum theory, the transition being made by simple correspondence principle. The method clearly and simply accounts for all the results given hitherto by the meson theory of nuclear forces; e.g., the equivalence of the pseudoscalar and pseudovector couplings for pseudoscalar mesons is simply demonstrated, including the cancellation of the $1/r^3$ singularity.

5245
REPRESENTATIONS OF THE GROUP OF ROTATIONS AND INVERSIONS. APPLICATIONS OF PARITY CONSERVATION IN QUANTUM MECHANICS. II. ANNIHILATION OF A DIRAC PARTICLE AND ANTIPARTICLE. Louis Michel. Compt. rend. 234, 2161-3(1952) May 26. (In French)

The algebra of group representations applicable to the annihilation of a spin-½ particle and antiparticle is discussed. For scalar (S), vector (V), pseudovector (A), and pseudoscalar (P) bosons (cf. NSA 6-2546), the following annihilations are forbidden: for the ^1S state, SS, PP, SSS, SV, PA, and PPS; for the ^3S state, SP.

5246
ON THE ABBREVIATED THEORY OF PARTICLES OF SPIN ½. J. Serpe. Physica 18, 295-306(1952) May. (In French)

It is shown that the unquantized two-component wave equations considered by Weyl (Z. Physik 56, 330(1929)) are related to Majorana's abbreviated theory (Nuovo cimento 14, 171(1937)) for m = 0 (neutrino) in almost the same way as the one-electron theory is related to the electron-positron theory. In a Fock two-component representation (configuration space method) a Majorana free particle (with m = 0) may be described by Weyl's equations or by their complex conjugates, according to its spin state. The two values of the spin play a role simliar to that of the two values of the charge in the electron-positron theory. (auth)

URANIUM AND URANIUM COMPOUNDS
5247
Brookhaven National Lab.
LATTICE CONSTANTS AND MAGNETIC SUSCEPTIBILITIES OF SOLID SOLUTIONS OF URANIUM AND THORIUM DIOXIDE, by Emil Slowinski and Norman Elliott. [nd] 9p. (BNL-1199)

Thorium and uranium dioxides are miscible in all proportions. Solid solutions may be prepared by fusion in borax at 1000 to 1200°C, and the lattice constants of the cubic crystals are those predicted by Vegard's rule. Magnetic susceptibilities of these solutions obey the Weiss-Curie law. The magnetic moment of the U^{+4} ion decreases with dilution, and approaches the "spin-only" value, a result in agreement with the observations of other investigators. (auth)

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NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol. 6, No. 6B, page "SUPPLEMENT 1".

$_3Li_2^6$	$He^4(p,p)He^4$ I(ground) = $p^{3/2}$ I(2.5 level) = $p^{1/2}$		M. Heusinkveld, G. Freier, Phys. Rev. 85, 80(1952).
$_6C_6^{12}$	Level $N^{15}(p,\alpha)$ 4.432 ± 0.010		A. Schardt et al., Phys. Rev. 86, 527 (1952).
	$p,\gamma\gamma(\phi)$ $B^{11}(p,\gamma)$ I(4.4 level) = 2 I(16.4 level) = 2		G. M. Lewis, Phil. Mag. 43, 690(1952).
$_6C_8^{14}$	$\bar{E}_\beta/\tau = 2.58 \times 10^{-13}$ Mev/sec calorimeter		G. H. Jenks, F. H. Sweeton, Phys. Rev. 86, 803(1952).
N	σ_t(0.2 – 1.8 Mev) graphs		J. J. Hinchey et al., Phys. Rev. 86, 483 (1952).
$_7N_8^{15}$	σ_t(0.2 – 1.8 Mev) graphs		J. J. Hinchey et al., Phys. Rev. 86, 483 (1952).

E_θ	Γ(kev)	J
0.430	3.5	> ½
0.492	7.5	
0.639	43	½+
0.998	46	³⁄₂+
1.120	19	⁵⁄₂
1.188	≤3.2	> ½
1.211	13	½−
1.350	22	⁵⁄₂
1.401	54	³⁄₂−
1.595	22	⁵⁄₂
1.779	24	⁵⁄₂

$_8O_8^{16}$	Resonances $N^{15}(p,\ldots)$		A. Schardt et al., Phys. Rev. 86, 527 (1952).

p,α	p,αγ	p,γ
0.338	0.429	1.05
1.05	0.898	
1.210	1.05 ?	
	1.210	

	$p,\gamma(\theta)$ $F^{19}(p,\alpha)O^{16}$ I(6.1 level) = 3− I(6.9 level) = 2+ I(7.1 level) = 2−		J. E. Sanders, Phil. Mag. 43, 630(1952).
$_{11}Na_{12}^{23}$	Levels $Mg^{26}(d,\alpha)$ 0.43 ppl 2.07		P. M. Endt et al., Phys. Rev. 86, 518 (1952).
$_{12}Mg_{12}^{24}$	Levels Al(p,α) 4.11 4.21 E_p=8		E. M. Reilley et al., Phys. Rev. 86, 857 (1952); 85, 704A (1952).
$_{12}Mg_{14}^{26}$	Levels $Mg^{25}(d,p)$ ppl 1.825 4.92 2.97 5.27 3.97 5.32 4.35 5.50 4.86 6.15		P. M. Endt et al., Phys. Rev. 86, 518 (1952).
$_{12}Mg_{15}^{27}$	Level $Mg^{26}(d,p)$ ppl 0.987		P. M. Endt et al., Phys. Rev. 86, 518 (1952).
$_{13}Al_{14}^{27}$	Capture γ's $Mg^{26}(p,\gamma)$ a coin		L. N. Russell et al., Phys. Rev. 86, 819 (1952).

E_θ	E_γ
0.450	6.2
0.813	7.2
0.840	5.3
0.954	7.3
1.015	5.5

	Levels Al(p,p) 0.84 4.12 5.22 1.02 4.47 5.34 2.26 4.58 5.50 2.78 4.65 5.56 3.05 4.88 5.62 3.74 5.00 5.74 4.02 5.11 E_p=8		E. M. Reilley et al., Phys. Rev. 86, 857 (1952); 85, 704A (1952).
$_{14}Si_{17}^{31}$	β^- 1.486 s No γ		A. H. Wapstra, Phys. Rev. 86, 561 (1952).
$_{17}Cl_{18}^{35}$	$q(Cl^{35})/q(Cl^{37})$ depends on molecule and temp. Mic		T. C. Wang et al., Phys. Rev. 86, 809 (1952).
$_{18}A_{19}^{37}$	$Cl^{37}(p,n)$		P. H. Stelson, W. M. Preston, Phys. Rev. 86, 807(1952).

Level	Rel. σ	ppl
0	0.78	
1.41	0.22	

$_{25}Mn_{28}^{53}$	$Cr^{53}(p,n)$		P. H. Stelson, W.M. Preston, Phys. Rev. 86, 807(1952).

Level	Rel. σ	ppl
0	0.35	
0.37	0.43	
1.27	0.22	

Ni	Levels Ni(p,p) 17 values E_p=8 unassigned to isotopes		R. Ely, Jr. et al., Phys. Rev. 86, 859 (1952); 85, 704A (1952).
$_{28}Ni_{30}^{58}$	$\sigma[Ni^{58}(n,2n)36^h]Ni$ Yield for $E_n \simeq 12 - 19$		H. C. Martin, B. C. Diven, Phys. Rev. 86, 565(1952).

$_{28}Ni^{59}_{31}$	$Co^{59}(p,n)$ Level Rel. σ ppl 0 0.28 0.33 0.72		P. H. Stelson, W. M. Preston, Phys. Rev. 86, 807(1952).
$_{28}Ni^{60}_{32}$	Levels Ni(p,p) 1.34 E_p=8 1.48 2.50		R. Ely, Jr. et al., Phys. Rev. 86, 859 (1952); 85, 704A (1952).
$_{29}Cu^{62}_{33}$	τ 9.8^m Cu(n,2n)		H. C. Martin, B. C. Diven, Phys. Rev. 86, 565(1952).
$_{29}Cu^{63}_{34}$	$\sigma[Cu^{63}(n,2n)9.9^mCu]$ Yield for $E_n \simeq 11-19$		H. C. Martin, B. C. Diven, Phys. Rev. 86, 565(1952).
$_{35}Br^{79}_{44}$	$q(Br^{79})/q(Br^{81})$ Mic (000)* 1.199 (010)** 1.197 [J = 5 – 6, BrCN]		S. J. Tetenbaum, Phys. Rev. 86, 440 (1952). *Ground, **first excited vibrational states.
$_{35}Br^{80}_{45}$ 18^m	β_1 85% 2.0 sl β_2 (?) 15% 1.1 No ce$^-$, no $\beta\gamma$		J. Laberrig e-Frolow, Compt. rend. 234, 2599 (1952).
$_{35}Br^{83}_{48}$	γ (0.046) $(\beta e^-)cc$ $\tau<10^{-2s}$		J. Walker, Proc. Phys. Soc. (London) A65, 449 (1952).
$_{36}Kr^{83}_{47}$ 1.9^h	γ_1 0.009 pc $\alpha\sim10$ $\tau<10^{-7s}$ γ_2 0.032 pc K/L + M = 0.32		P. T. Burrett, Proc. Phys. Soc. (London) A65, 450 (1952). Se(d); chem.
$_{41}Nb^{97}_{56}$ 76.0^m	τ 72.1^m β^- 1.4 a γ ~0.7 a $\beta\gamma$ not function of E_β		C. E. Mandeville et al., Phys. Rev. 86, 813(1952); 86, 631A(1952). $Zr^{96}(n,\gamma\beta)$; chem.
$_{43}Tc^{99}_{56}$ 5.9^h	γ 0.0020 sl $e^-(0.002\gamma)$ $e^-(0.141\gamma)$		H. Schneider et al., Helv. Phys. Acta 25, 259(1952).
$_{44}Ru^{103}_{59}$	γ's $s\pi$,ce$^-$ 0 E_γ K/L 0.0396 0.10 0.0529 1.0 0.295 ? 0.498 8 0.611 4		J. M. Cork et al., Phys. Rev. 86, 575 (1952).
	γ 0.4979 $s\pi\sqrt{2}$; ±0.0008 pe$^-$		A. W. Knudsen, Phys. Rev. 86, 571 (1952).
$_{45}Rh^{105}_{60}$	β^- 10% 0.26 a$\beta\gamma$ γ 0.080 ? scin vw 0.157 10% 0.322 $(0.26\beta)(0.322\gamma)$		G. E. Boyd, Phys. Rev. 86, 578(1952). Ru(pile n); chem.
$_{47}Ag^{107}_{60}$ 44^s	No ce$^-$ from 1 to 10 kev sl;e$^-$e$^-$		H. Schneider et al., Helv. Phys. Acta 25, 259(1952).
$_{47}Ag^{109}_{62}$ 39^s	No ce$^-$ from 1 to 10 kev sl;e$^-$e$^-$		H. Schneider et al., Helv. Phys. Acta 25, 259(1952).
$_{50}Sn^{124}_{74}$	$\tau_{\beta\beta}$ $>10^{17}y$		E. L. Fireman, D. Schwarzer, Phys. Rev. 86, 451(1952).
	$>0.3\times10^{17}y$		R. M. Pearce, E. K. Darby, Phys. Rev. 86, 1049(1952).
$_{53}I^{131}_{78}$	β^- 13.3% 0.339 $s\pi\sqrt{2}$ 84.7% 0.606 ~1.4% 0.807 γ_2 0.284 E2,M1 γ_3 0.364 E2 γ_4 11.8%* 0.638 E1 γ_6 1.5%* 0.724 E2,M1 α_K** K/L K/L + M γ_2 0.036 5 5 γ_3 0.0174 6.6 4.7 γ_4 0.0021 5.2 γ_6 0.0037		D. Rose et al., Phys. Rev. 86, 863 (1952). *Assuming γ_4/γ_6 = 7.8. **Assuming γ_2/γ_3 = 0.08.
	γ_1 4.3% (0.080) pc,scin, α_K = 1.8 Xγ γ_3 80.7% (0.36) γ_7 0.3% (0.082) from X(0.638γ)		P. E. Cavanagh, Phil. Mag. 43, 648 (1952).
$_{54}Xe^{135}_{81}$	σ_a(th n) 3.5×10^6		Office of Classification, AEC, April 7, 1952; Nature 169, 871 (1952).
$_{77}Ir^{195}_{118}$?	τ 2.3^h β^- ~1 a Not parent of $18^h Pt^{197}$		D. Christian et al., Phys. Rev. 86, 946 (1952). Pt(≤30-Mev γ); chem. Assignment from yield.
$_{77}Ir^{197}_{120}$?	τ 7^m		D. Christian et al., Phys. Rev. 86, 946 (1952). Pt(≤30-Mev γ); chem. Assignment from yield
$_{78}Pt^{196}_{117}$	τ 3.8^d γ_1 90% 0.029 sl;ce$^-$ γ_2 90% 0.097 e$^-$e$^-$ γ_3 10% (0.126) γ_4 100% 0.129 α_K α_L α_M γ_1 ≥6 ≥1.3 γ_2 7.4 1.3 0.3 γ_4 ~∞ K/L = 0.26		A. de-Shalit et al., Helv. Phys. Acta 25, 279(1952). Pt(d), Pt(n); chem. Assignment from Au^{196} γ's, q.v.
$_{78}Pt^{197}_{119}$	β^- 1.5% (0.48) sl 98.5% 0.67 γ 100% 0.077 ce$^-$, 1.5% 0.191 pe$^-$ $e^-(0.191\gamma)$ $e^-(0.077\gamma)$		H. Schneider et al., Helv. Phys. Acta 25, 259(1952).

$_{78}Pt^{197}_{119}$? 80^m	τ 88^m ce^-	D. Christian et al., Phys. Rev. 86, 946 (1952). Pt(≤70-Mev γ); chem. Not produced by Au(≤70-Mev γ).
$_{79}Au^{198}_{119}$	γ 35% 0.029 sl;e^-e^- 100% 0.097 3.5% 0.126 K/L<1.8	A. de-Shalit et al., Helv. Phys. Acta 25, 279(1952). Pt(d); chem.
	No ce^- from 1 to 10 kev sl;e^-e^-	H. Schneider et al., Helv. Phys. Acta 25, 259(1952).
$_{79}Au^{199}_{120}$	γ (0.411) E2 α_K = 0.0318* α_L = 0.0103* α_M = 0.0031*	L. Simons, Phys. Rev. 86, 570(1952). *Neglecting β^- branching; assuming K capture ~5%.
	No ce^- from 1 to 10 kev sl;e^-e^-	H. Schneider et al., Helv. Phys. Acta 25, 259(1952).
$_{79}Au^{199}_{120}$	τ 3.16^d β_1 20% (0.242) sl β_2 73% 0.291 β_3 7% 0.443 γ_1 5% 0.051 ce^-, γ_2 78% 0.157 pe^-, γ_3 15% 0.208 e^-e^- α_K α_L α_M γ_1 ≥1.8 ≥0.5 γ_2 0.33 0.50 0.17 γ_3 0.98 0.17 0.07	A. de-Shalit et al., Helv. Phys. Acta 25, 279(1952). Pt(n,$\gamma\beta$); chem.
	No ce^- from 1 to 10 kev sl;e^-e^-	H. Schneider et al., Helv. Phys. Acta 25, 259(1952).
$_{80}Hg^{197}_{117}$ 25^h	No ce^- from 1 to 10 kev sl;e^-e^-	H. Schneider et al., Helv. Phys. Acta 25, 259(1952).
$_{81}Tl^{202}_{121}$	τ 12.5^d Tl(n,2n) γ 0.43 scin	H. C. Martin, B. C. Diven, Phys. Rev. 86, 565(1952).
$_{81}Tl^{203}_{122}$	$\sigma[Tl^{203}(n,2n)12.5^d]Tl$ Yield for $E_n \simeq 12-18$	H. C. Martin, B. C. Diven, Phys. Rev. 86, 565(1952).
$_{82}Pb^{209}_{127}$	β^- 0.64 s No γ, no K x ray No e^- with E_{e^-} >0.030	A. H. Wapstra, Phys. Rev. 86, 562(1952).
$_{84}Po^{210}_{126}$	Pb L x ray/$\alpha = 2.2 \times 10^{-4}$ Pb K x ray/$\alpha = 1.6 \times 10^{-5}$ crit a $(0.80\gamma)/\alpha = 1.6 \times 10^{-5}$ a	M. Riou, J. phys. radium 13, 244 (1952).
$_{94}Pu^{239}_{145}$	$\bar{\sigma}_c$(th n) 361 $\bar{\sigma}_f$(th n) 664 Averages for Maxwellian distribution, kT = 0.025 ev	Office of Classification, AEC, April 7, 1952; Nature 169, 871(1952).

Q's Between Ground States

$Be^9(d,p)Be^{10}$	+4.591 ± 0.008	E. D. Klema, G. C. Phillips, Phys. Rev. 86, 951(1952).
$C^{12}(d,p)C^{13}$	+2.732 ± 0.006	
$O^{16}(d,\alpha)N^{14}$	+3.111	R. J. Van de Graaff et al., Phys. Rev. 86, 966(1952).
$O^{16}(d,p)O^{17}$	+1.918 ± 0.008	E. D. Klema, G. C. Phillips, Phys. Rev. 86, 951(1952).
$P^{31}(d,n)S^{32}$	+6.3 ± 0.2	S. C. Snowdon, Phys. Rev. 86, 630A(1952).